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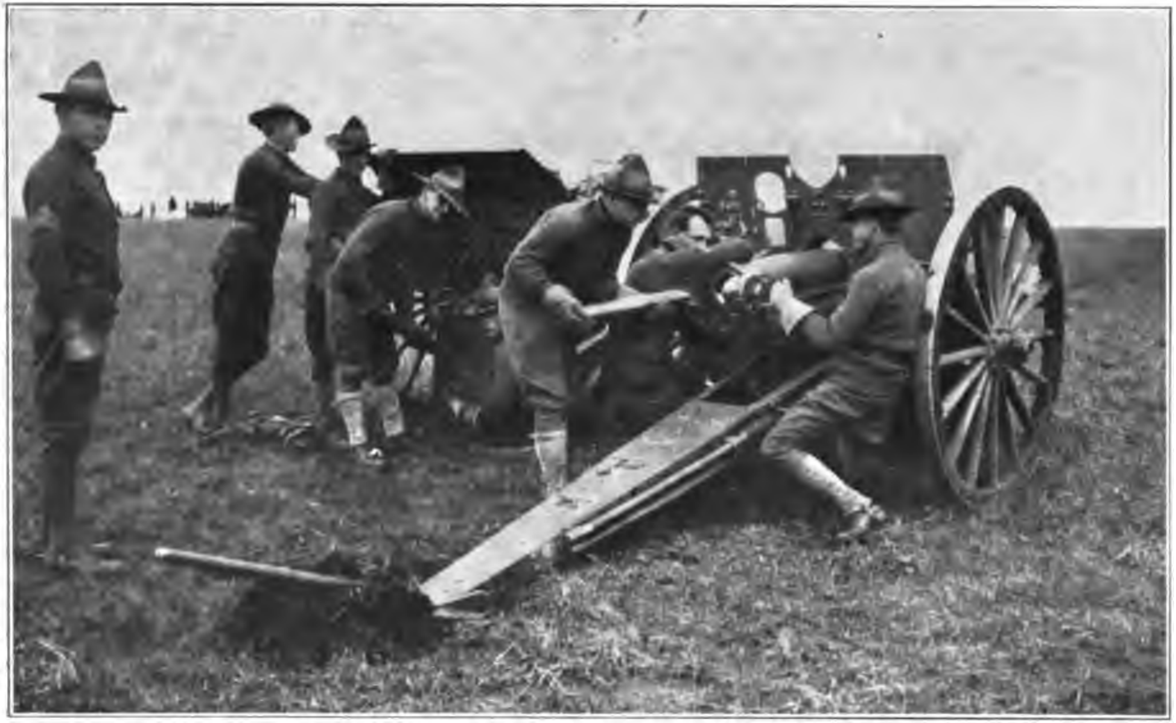

THREE-INCH GUN IN ACTION.

Alexander Zinod

NOTES

—ON—

FIELD ARTILLERY

—FOR—

OFFICERS OF ALL ARMS

By OLIVER L. SPAULDING Jr.,
Captain Fourth Field Artillery, United States Army.

SECOND EDITION

U. S. CAVALRY ASSOCIATION.
1914.

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PREFACE TO THE FIRST EDITION

This little book is an expansion and rearrangement of a course of lectures given by me in the United States Infantry and Cavalry School, and has been prepared for publication in its present form at the suggestion of Major JOHN F. MORRISON, General Staff, Senior Instructor Department of Military Art, Army Service Schools. Possibly it may help, in a small way, to interest officers of other arms in Field Artillery, and thus strengthen the feeling of unity throughout the service.

The books to which I have most frequently referred in collecting material are the following:

Rouquerol: "The Tactical Handling of Quick-Firing Field Artillery."
May: "Field Artillery with the Other Arms."
Hohenlohe: "Letters on Artillery."
Rohne: "Die Taktik der Feldartillerie für die Offiziere aller Waffen."
Langlois: "L'Artillerie de Campagne en Liaison avec les autres Armes."
Culmann: "Le Canon à Tir Rapide dans la Bataille."
Layriz: "Moderne Feldartillerie."
Drill regulations, official and semi-official manuals of our own and other armies.
Reports of American observers in Manchuria.
Journal of the United States Artillery.

Rouquerol's and May's books are particularly recommended to those who care to read more on the subject.

Among the officers who have rendered me assistance, I wish to express especial obligation to Captain DWIGHT E. AULTMAN, Fifth Field Artillery, and Captain ARTHUR L. CONGER, Twenty-ninth Infantry, who have aided me by advice and criticism during the whole time that the manuscript was in preparation.

OLIVER LYMAN SPAULDING, JR.,
Captain Fifth Field Artillery.

FORT LEAVENWORTH, KANSAS,
June, 1908.

Prof. Alex Grist 4-17-19

PREFACE TO THE SECOND EDITION

This book, as originally published, was based upon the courses of lectures given by the writer in introducing systematic instruction in field artillery into the Leavenworth schools. In the six years that have elapsed since its appearance, various deficiencies and faults have been noted in it, and the book as a whole has fallen behind the times.

Nevertheless, its steadily increasing sales have indicated that it filled a gap in our military literature, and was of real use. In justice to its readers, therefore, a new edition has seemed necessary, especially as no other adequate presentation of the subject has appeared in the meantime. Collection of material for a new edition has long been in progress, and the work of preparation was begun in the Fall of 1913. The result is now submitted to the service.

While the original idea was to provide only an elementary school textbook, introducing the subject of field artillery to officers of other arms, conditions in our service have now changed and it seems that the time for so narrow a conception has passed. In this edition, therefore, the material has been not only revised but entirely rearranged, and the book rewritten. Some data have been incorporated that would be of little use in the conference room, but which will be found convenient for reference.

A departure has been made from the conventional plan, in that no special chapters are devoted to special classes of artillery, such as heavy and mountain guns. It is believed that these types are better understood by considering them, not as something distinct and peculiar, but simply as field artillery. For them the same principles hold as for field artillery in general; one need only keep in mind that they are special types with special powers and limitations, and that they should be coördinated with the other types so that each may do that work for which it is best adapted.

The original plan called for publication in the early Summer of this year. Sudden orders for field service interrupted the work, however; some two months were entirely lost, and writing in camp has necessarily been slow. The same reason—field conditions—has seriously hampered the work by limiting very strictly the reference books available; the writer has therefore to ask indulgence for some incompleteness, and for omission or lack of verification of references in some cases.

Thanks are due to a number of officers for assistance, particularly to Majors **DWIGHT E. AULTMAN**, Sixth Field Artillery, and **GEORGE G. GATLEY**, Fourth Field Artillery; Captains **RICHARD H. MCMASTER** and **CONRAD H. LANZA**, Fifth Field Artillery, and **ARTHUR L. CONGER**, Twenty-sixth Infantry.

OLIVER LYMAN SPAULDING, JR.,
Captain Fourth Field Artillery.

TEXAS CITY, TEXAS,
August, 1914.

CONTENTS

Chapter I.—Introduction. General characteristics of artillery. Evolution of its organization and tactics.

Chapter II.—Classification of artillery: guns, howitzers, and mortars; light, heavy, mountain and horse. Organization: gun, battery, battalion, regiment, brigade. Assignment to mixed units.

Chapter III.—Matériel. Guns and carriages, according to the classification of Chapter II; ammunition, instruments and accessories; foreign matériel.

Chapter IV.—Ammunition supply. Combat trains: battery reserves and regimental columns. Ammunition trains: organization and assignment. Operation of supply system.

Chapter V.—Technique of fire. Preparation and conduct of fire; adjustment; fire for effect; the sheaf of fire and the cone of dispersion; effect of fire.

Chapter VI.—Maneuver; communications and information; fire direction.

Chapter VII.—Artillery positions: reconnaissance and selection; occupation; change.

Chapter VIII.—Combat and march tactics.

Chapter IX.—Tactical connection; elaboration of ideas suggested in Chapter VIII; conduct of maneuvers; duties of umpires.

Chapter X.—Problems.

CHAPTER I.

INTRODUCTION.

GENERAL CHARACTERISTICS OF FIELD ARTILLERY.

Artillery, although often spoken of as a thing apart from the other arms, is really the one of all the arms which is least capable of such consideration. Infantry can, in many cases, be sufficient unto itself; cavalry, although generally an auxiliary to the infantry, can act independently. But artillery, while it is a powerful assistant to either of the other arms, is nothing by itself. Even the famous charge of Seidlitz's cavalry, upon the head of the allied column at Rossbach, could not have been made without the help of the eighteen twelve-pounders which Frederick placed on the Janusberg; but it was Seidlitz that struck the blow—the artillery was powerless to do more than give him the opening.

Auxiliary nature of artillery

An infantry or independent cavalry force is usually commanded by an infantry or cavalry officer. Artillery, from the very nature of things, is almost invariably under the command of an officer of another arm. Therefore, for the good of the service at large, it is important that officers of the other arms study the characteristics of artillery.

Utility of study

There are plenty of books intended to teach the artillerist his own business, just as there are plenty of books doing the same for the infantryman or cavalryman. And since field artillery always acts as an auxiliary, the artilleryman can get what he needs to insure intelligent coöperation out of the ordinary text books of the other arms.

Its difficulties

But when the infantryman or the cavalryman, who has to command or serve in a mixed force containing artillery, wants to find out how he may get the most good out of his guns, he finds himself in difficulties. The information that he wants is not collected; to understand one book, he is compelled constantly to refer to half a dozen others. Too often he gets the idea that the handling of a battery is a mystery, a highly technical matter, and decides that the best thing he can do is to let the gunner alone, to go his own mysterious way.

Errors of ignorance

It is not that the power of artillery is underrated. In fact, powers are very often attributed to it which it does not claim, and does not possess; missions are then assigned to it which it is incapable of performing, and disappointment shown when it fails.

Fire action only

This arm differs from the others, in the first place, in that it is capable of fire action only. The artilleryman is proud to remember Captain Norman Ramsey's horse battery at Fuentes de Onoro, which, being cut off by French cavalry, limbered up and charged, and so forced its way back to its friends; but he does not claim that it was artillery work.* The Prussian horse artillery used to

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***In this connection the following newspaper report of an incident in the present European war, appearing just at the moment of going to press, may be curious and interesting, if not instructive:**

"LONDON, Aug. 29.—A dispatch from St. Petersburg to the

practice, in time of peace, a charge by the mounted detachments, to permit a withdrawal of the guns from imminent danger; but the suggestion provokes only a smile now.

Being thus debarred from shock action, artillery has, as was its clear duty, sought to develop its fire power to the utmost. In so doing it has naturally evolved a matériel and a system for using it, which by comparison seem complicated. But most of the complications are for the artilleryman himself to deal with; others need consider them only in so far as it is necessary to enable them to appreciate the tactical powers and limitations of the arm.

But a certain amount of this technical information every officer should have; otherwise he will make one of two mistakes. He will so hamper his artillery with unwise or impossible orders that its energy is wasted; or he will leave his artillery commander to his own devices, without even giving him information which would enable him to act intelligently.

Caste spirit

There was a time when the artillery jealously guarded its technical information, and did not want to be understood. Up to the middle of the last century, an officer joining the Prussian artillery was required to promise not to betray the secrets of the corps. Hohenlohe remarks:*

Reuter Telegram Company recites a daring act credited to Prince Eristoff, a colonel in the Russian horse artillery.

"When the Germans were retreating from Stallupoehnen, a town of East Prussia, the prince ordered his men to unhitch their horses from their own guns, mount them and gallop after the Germans. Under a heavy fire the Russian cavalrymen went forward, captured the German guns and brought them back to their lines.

"Emperor Nicholas has conferred the Cross of St. George upon Prince Eristoff."—*Kansas City Star*, August 29, 1914.

***"Letters on Artillery," (Walford's translation, 3d Ed.) p. 153.**

"But he learned no secrets at all, and as on the other hand he was not told that what he learned was not a secret, he never knew whether he was not divulging secrets whenever he spoke about his arm, and he gladly stopped all conversation on the subject by saying that these were technical things about which he was not at liberty to speak. * * * The gunner was very much afraid of betraying secrets; but how could he betray them when he did not know any? I can assure you of this at least, that I myself never learned one. Ah! I am afraid that, by saying this, I have betrayed to you the very greatest secret of all."

In the same spirit Gen. Percin writes:*

"In the course of the thirty-five years during which I have attended autumn maneuvers, I have often been struck by the deference paid to me by the infantry commanders to whom I have been attached. This deference has sometimes made me feel uncomfortable. These commanders gave me very few orders; they preferred to consult me. They seemed to consider the artillery as a Sacred Ark, whose secrets were impenetrable. I have known some artillery officers inclined to keep up this mystery, which is a convenient means of permitting the gunner and the infantryman to take no notice of each other, while remaining very good friends."

But this spirit, happily, seems to be a thing of the past. Artillerymen understand that, as they can do nothing alone, it is to their advantage to associate themselves as closely as possible with the other arms.

This book, then, seeks to collect the most essential technical information, and make a few tactical applications of it, in the hope of aiding the officer of another arm to form an independent opinion on artillery matters. *He need not deprive himself of the expert advice of his artillery commander, but he should be able to pass judgment upon the suggestions he gets from him.* Then, when he gives an order to his artillery, he can give it with confidence, on his own responsibility—not merely approve, as a matter of routine, the recommendations made by his adviser.

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*"Artillery at the Picardy Maneuvers, 1910" (English Gen. Staff translation) p. 163.

Round shot

Early artillery weapons sought to increase fire effect by increasing the size and weight of the individual projectile—the round shot. Besides being in itself more powerful than a musket ball, and so possessing great battering power, this projectile was capable of producing effect on a very deep target, by means of its adaptability to ricochet fire.

Grape shot

The next step was to get distribution in breadth, by means of grape shot. This could be used only at very close range, but gave then an almost annihilating effect. The single shot, whose power was more than sufficient against animate targets, was broken up into a great number of smaller ones, each powerful enough for its purpose, and these smaller projectiles distributed with fair uniformity over a considerable area.

Nature of artillery fire

We thus find that the two important characteristics of artillery fire were recognized at an early day—battering power, and the ability to sweep an area. Later improvements have simply developed these two kinds of fire.

The round shot as a battering projectile has now been superseded by the shell. This is simply a fly-

Shell

ing mine; as heavy a charge as possible of high explosive is confined in a steel envelope only strong enough to bear the shock of discharge with safety, and provided with a percussion fuze which will detonate it on striking a resisting target. In some such projectiles a delay-action fuze is used, which retards the explosion long enough for the shell to penetrate or bury itself in the target.

Another type of shell is made with thicker walls, and hence a smaller bursting charge. This is intended to be burst in the air at a certain point of its trajectory, by means of a time fuze, so scattering fragments of considerable size, and giving an effect similar to that of grape shot, but at a longer range.

Shrapnel

This brings us to the shrapnel, which is now the principal field artillery projectile. This differs from the second type of shell, in that the envelope is thin, and the bursting charge very small; the extra space is filled with bullets. Thus it is nothing but a very efficient device for transferring a grape or canister effect to a long range.

The power of shrapnel fire, then, is due entirely to its ability to cover a considerable area. Hence, it should never be attempted to use such a projectile in single shots against a small target. Its effect is comparable, not to that of a rifle, but to that of a number of rifles controlled by one commander.

Shrapnel fire is, essentially, identically the same thing as collective rifle fire, but generated in a peculiar manner and capable of special applications.

Gun groups

To get the proper benefit out of this characteristic, the area covered must be made of dimensions suited to the occasion. This compels the use of guns in groups of various sizes;

as Hohenlohe strikingly says, "A single gun is no gun at all."*

In the early days of artillery it was customary to assign the lighter guns, singly or in pairs, to infantry battalions; but we find instances of massing them more and more frequently, until, about the beginning of the nineteenth century, the battalion gun disappeared.

Battalion guns

At the battle of Marignano (1515) all the French guns were massed to sweep the line of the Swiss advance. "I pray you," said the Chevalier Bayard to the Grand Master of the Artillery, "fire seven or eight guns all together"; the chronicle goes on to relate that they "made such gaps in the enemy's ranks that one saw Swiss blown into the air like powder."†

Gustavus Adolphus improved his light guns greatly, increasing both their mobility and their rate of fire. His heavy guns were grouped into large batteries, and he often assembled the battalion guns to reinforce or replace them.

Masses

Frederick the Great, in his earlier battles, paid but little attention to his artillery; but when he finally did begin to appreciate it he did much for its improvement. He used his guns habitually in masses; and he is usually said to have been the first to organize horse artillery, which could keep pace with cavalry, although Russian writers have sometimes sought to claim the credit for Peter the Great.*

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*"Letters on Artillery" (Walford's translation, 3d Edition,) p. 392. Like all epigrams, this statement is true only in a qualified sense. The point made is not that, having only one gun, we should not use it, but that, having several, we should use them to the best advantage. We find many instances, notably in South Africa, of single guns being made very useful; but the Boer guns in question were usually of heavy caliber and hence high individual power; and in general, separate use is found to be accounted for by some peculiarity in the target or in the situation, or else by the fact that only one gun was available.

†Rouquerol, "Tactical Handling of Quick-Firing Field Artillery" (Radcliffe's translation) p. 117.

His enemies, too, the Austrians, had a most efficient artillery at this time. Lichtenstein, their great artillery general, followed the same plan as Frederick, in habitually using his heavier guns in masses.

Napoleon, himself an artillery officer, placed great reliance on this arm. He said, "It is the artillery of my Guard that decides most of my battles; for having it always at hand, I can use it wherever I wish." He used his guns in imposing masses, with the most decisive effect.

One of his brilliant artillery generals, Sénarmont, showed an audacity at Friedland that startled even his master. He formed all the artillery of Victor's corps, thirty-eight guns, into one battery, and advanced with it boldly ahead of the French line to within 400 paces of the Russian infantry. Napoleon's first thought was that Sénarmont, with his whole command, was deserting to the enemy; then, seeing the great battery come into action, his feeling changed to one of anxiety lest it be lost, and he sent an aide to recall it. But Sénarmont only replied, "Let me and my gunners alone; I will be responsible," and advanced to 200 paces range. His fire drove the Russians from the field; he reports their loss as 4,000 killed, his own as 11 killed and 45 wounded, and his ammunition expenditure as 2,516 rounds.

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*Translation from Voyennui Sbornik, in Journal of the Royal Artillery, March, 1912.

At Wagram, formidable French batteries took a decisive part no less than four times. First, an Austrian attack on Napoleon's right was checked, chiefly by artillery fire, and Davout began to make headway there. Next, the rest of the Austrian line coming on, it was checked in the center by a line of 100 field guns; on the left it continued to gain ground until it came under fire from the heavy guns in position on the Lobau, when Massena managed to hold it.

Davout, meanwhile, had been pushing his flank attack; when Napoleon saw that this was succeeding, he advanced all along the line. Massena made a counter attack on the left, where the troops opposed to him were already shaken by the fire from the Lobau; and in the center the great battery of 100 guns advanced and opened the way for the decisive charge of the day, which forced the enemy from the field.

Napoleon's opponents were long in acquiring the skill and boldness necessary to compete with his artillery. Even as late as 1813, at the battle of Bautzen, where the Allied artillery was used with great effect, some of the Prussian captains hesitated to engage their full force, and held parts of their eight-gun batteries in reserve. But a little later in the same year, at Leipzig, the Allied artillery was handled in a manner that compelled Napoleon to admit that "at last they had learned something."

In our own Civil War, we find most conspicuous instances of the use of guns in mass. At Malvern Hill, McClellan concentrated his batteries for defense, and supported them by fire from the gunboats in the James River. At Fredericksburg, Burnside crowned all the hills on his side of the river with guns, to cover his offensive movement.

At Gettysburg the guns were heavily massed on both sides. Longstreet's attack upon the Third Corps at the Peach Orchard was prepared by 64 guns, and most of this line advanced to support the successful infantry. And the Confederate advance here was checked largely by artillery—the fragments of the Third Corps batteries, aided by batteries sent in from the Second and Fifth Corps, and from the Artillery Reserve.

On the last day of the battle, Pickett's charge was supported by 75 guns of Longstreet's corps and 60 of Hill's. The Federal position being cramped, an equal force could not be gotten into action; but all for which room could be found, about 80, were assembled to meet the attack.

In all the great battles of the Franco-Prussian War, masses of guns played a leading part. But no other achievement of the Prussian batteries could compare with the terrible "circle of fire" formed by them at Sedan. Southwest of Sedan was one mass of 114 guns; on the south, 36; on the east, 144; on the northeast, 90; and on the northwest, 156. In all, 540 guns were in action, and 100 more were present, but could not be used on account of lack of space. Hohenlohe says that some of the batteries of the Twelfth Corps came up to reinforce the Guard artillery, and their commander took it as a personal insult when he was informed that there was no room for him.*

In Manchuria the mass appeared in a new form. Instead of compact masses of guns, so close that reinforcing batteries failed to get in for lack of room, or, as at Gravelotte, crowded into the gun intervals of batteries already in action,* we see long thin lines, concentrating their fire upon the desired point from widely separated positions. Thus, at Liao Yang, the Japanese concentrated the fire of 198 field, 36 mountain, and 48 heavy guns upon the Shushanpu position; but they were dispersed over a long line, a deep crescent over 10,000 yards from point to point.†

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*"Letters on Artillery" (Walford's translation, 3d Ed.) p. 51.

Concentration of fire is what has always been sought. Concentration of guns has been accepted as a necessary evil. To get the first without the second two things are necessary—long range, and means of controlling fire from a distance. The range has gradually been lengthened, but the necessary control of fire was never attained until the field telephone came. The principle is the same at Marignano and Liao Yang; only the method is changed.

To sum up, we find that we have a powerful unit, which is very small and compact, and hence particularly susceptible of control. The range being long, it is possible to produce an effect at will upon any one of many targets, or to concentrate the fire of widely separated groups upon one target. The guns being capable of very rapid fire, this effect may be made exceedingly intense.

Summary: powers and limitations of artillery

Since it is unnecessary, with the present laying instruments, that each gunner see the target at which he is firing, the guns may, if desired, be entirely concealed. They may thus get exceptional opportunities for acting by surprise, and it is very difficult to reply effectively to their fire.

***Balck, Taktik, II, 361; Krueger's translation, 421.**

†Kriegsgeschichtliche Einzelschriften, 43—44, pp. 24-25.

On account of the fixed support upon which the guns rest, the accuracy of their fire is less affected than that of the other arms by excitement and nervousness of the men.

Loss of men has relatively little effect upon the volume of artillery fire; that is, if a gun has lost half its cannoneers it has by no means lost half its fire power. The ultimate unit is not the man, but the gun; and the gun can remain in action as long as there is a single man to serve it. Not only *can*, but, when necessary, *does*; at Colenso, when Colonel Long's two batteries were lost, several of the guns were served to this extreme limit.

On the other hand, artillery naturally has "the defects of its qualities." For example, it is, as has been said, good for fire action only. It is useless, helpless, and exceedingly vulnerable while in motion; a gun with its team forms a target almost as large as a platoon of cavalry in column, and even the loss of a single horse causes confusion and delay. Its movement is greatly affected by the terrain and the condition of the roads, and the effectiveness of its fire by weather, time of day, etc.

CHAPTER II.

CLASSIFICATION AND ORGANIZATION OF FIELD ARTILLERY.

Power vs. mobility

In designing any gun intended for use in the field, there are two important requirements—power and mobility.* Granting that a general type of gun has been decided upon, it is evident that any increase in one of these two factors is at the expense of the other. It is necessary to balance the two, keeping in mind the specific purpose of the gun under consideration.

Double classification

We thus find it necessary to have several distinct classes of gun, ranging from the very powerful and almost immobile to the very mobile but comparatively weak. The general classification is—siege, heavy field, light field, horse and mountain guns.

Besides this classification, based upon power, there is a second, based upon the shape of the trajectory.

***It may not be superfluous to point out that implicit in the question of mobility is the question of road weight. A gun which puts too heavy a load on a single pair of wheels tears up the roads badly, and may require special bridges. This latter point is so important, even for comparatively light guns, that one country, Austria, has assigned to each battery a special bridge equipment, capable of being packed in the rear chest of a store wagon; it is sufficient for 3.6 meters of bridge, or, combining the equipment of two batteries, 5.4 meters. (See Field Artillery Journal, December, 1912, p. 639.)**

For the attack of targets that can be reached by it, flat trajectory fire is preferred, on account of its power and accuracy. Cases frequently arise, however, where such fire is useless, either the gun or its target being so concealed and sheltered by entrenchments or the accidents of the terrain that higher angles of departure or fall become necessary.

To provide for both cases, there must be two or three types of weapon—the long gun for flat trajectory, the shorter howitzer for curved, and sometimes the still shorter mortar for high angle fire. We thus subdivide our original classes, and distinguish, for example, the light field howitzer, the heavy field gun, the siege mortar, etc.

Evidently, the number of separate calibers that might be adopted to make up a complete series of types is very large. But it is important to reduce this number to a minimum, both from considerations of economy and also to avoid complication in ammunition supply. Each army must determine, according to the conditions which it has to meet, how many and what calibers it should adopt.

Organization

The guns being selected, the question of organization arises. As has already been shown, a single gun is rarely of any use; we are thus brought to consider, as our first step, how many guns should be included in our smallest permanent unit.

This unit, called the battery, must be large enough to utilize efficiently the properties of artillery fire above indicated, but no larger. If it is smaller, our organization has evidently failed at the outset; the unit will fail to do its work, and two or more will habitually be consolidated. Each little unit, of course, will have been provided with a complete set of the necessary instruments, and placed under the command of an officer of appropriate rank and experience; thus part of the officers and part of the instruments will be wasted. On the other hand, if it is larger than necessary it will habitually be split up; then some of the subdivisions will be unprovided with instruments, and some of them may have to be entrusted to officers whose knowledge and experience is inadequate.

Formation of batteries

It is also essential that the primary unit be of a size which is conveniently handled, in action, in camp and on the march; and it should include within itself a supply of ammunition, suitably proportioned to its number of guns.

When the necessity of using guns collectively instead of individually began to be perceived, the first step was simply to form masses of guns temporarily, when and where they were needed, but to make no permanent organization. The inconveniences of this were apparent, and finally all armies adopted the plan of regularly organized batteries. But for a long time after this was done, it was not everywhere accepted, as it is now, that all the pieces of a single battery should be of the same type and caliber.

The number of guns in a battery has been gradually reduced, as a result of experience and of changes in matériel, from as many as twelve to as few as four, and suggestions are sometimes made for even smaller batteries. Russia is now the only power that maintains batteries of over six guns, and even here the actual fire unit is usually the half battery. Powers that have batteries of over four guns

Size of battery

retain them chiefly for financial rather than military reasons; fewer officers and men are needed for two six-gun than for three four-gun batteries. There is a limit to the number of rapid fire guns that one man can work up to their maximum efficiency, and it is generally agreed, even if not admitted, that six is beyond that limit.

Another consideration affecting the size of the battery is ammunition supply. Any considerable increase in the number of carriages would render the battery unwieldy; hence as it becomes necessary to carry more and more ammunition per gun, the permissible number of guns per battery grows less and less.

Mixed troop units

We see, then, that the battery is primarily a technical unit—"a firing machine," as it is often called. For tactical handling it is necessary to group batteries into higher units; and, since artillery can not work alone, these tactical units must be organically connected with some of the larger mixed units. It was formerly customary, even after the disappearance of the battalion gun and the formation of permanent batteries, to give a few guns to infantry brigades, or even smaller units. It is not now usual to make permanent assignments to anything smaller than the infantry or cavalry division. Some armies give all the light guns to the divisions; others retain a part of them under the direct control of the corps or army commander. Heavy guns are rarely assigned to any unit smaller than an army corps.

In our service, by law, field artillery includes all the artillery that accompanies an army in the field, including light, horse, siege and mountain artillery. It will be noted that this legislative definition makes no mention of heavy field artillery; this is due to the fact that when the reorganization of 1907 was effected, weapons of the type then known abroad (and now at home) as heavy field guns were, after an old custom, called siege guns by us. But as a result of the South African and Manchurian wars, it has gradually become clear that something more powerful than the light gun must habitually accompany an army in the field, and that nothing hitherto classed as siege artillery can now claim that title, understanding it to mean something capable of attacking permanent or semi-permanent works. In current speech, our service now conforms to the prevailing terms elsewhere. Heavy field artillery means anything that can be handled by eight heavy horses (which is generally regarded as the largest team suitable for regular use in the field); and siege artillery means anything that can be moved into position by a traction engine or a railway train, even up to the 11-inch howitzer firing a 700-pound projectile.

American classification

If the law of 1907 were to be written today, the word *heavy* would probably be substituted for *siege*. We have no such thing as a siege gun, properly so called, although tentative designs have been made. If occasion should arise for us to do any real siege work it would probably be handled by Coast Artillery troops, with such seacoast or heavy field guns as it might be possible to get to the position. Some of the old siege matériel has been turned over to the Coast Artillery for instruction purposes, and such training as is practicable is given troops of that arm in its management.

The light battery is the standard and predominant type, here as in other countries. It is calculated particularly for service with infantry, but can, in emergencies, keep pace with cavalry on any ordinary marches.

Light battery

Its teams are of six horses; it maneuvers habitually at the trot, exceptionally at the gallop. We have given up the six-gun organization, and our battery consists of four guns and twelve caissons, besides a forge and store wagon, constituting a small repair shop, and the allotted field wagons. The ammunition carried amounts to 1432 rounds, or 358 per gun; a proposed reduction in the size of the caisson chest, to save weight, would reduce this to 316. The battery is divided into eight sections of two carriages each; the first four are gun sections, a piece and a caisson each, and the others caisson sections of two caissons each. A supernumerary or ninth section includes all the other vehicles; it is commanded by the quartermaster sergeant, the other sections by sergeants. Two sections constitute a platoon, commanded by a lieutenant. The whole battery is commanded by a captain. In peace the fourth platoon (seventh and eighth sections) is not manned nor horsed.

Horse battery

Horse artillery is the same as light, but equipped primarily for service with cavalry. The cannoneers are individually mounted instead of riding on the carriages or walking as in light batteries. The organization is identical with that of light artillery, but to save weight less ammunition is carried.

Mountain battery

Mountain artillery takes the place of light where wheel transportation cannot be used. The guns and carriages are smaller and lighter, and so constructed as to be quickly dismantled for pack transportation. The organization is similar to that of light batteries, but with many minor differences due to its special form of transport. Mounttain guns are of course much inferior to light in power, and are used only in places not accessible to others; but such places are found not alone in the mountains. This type of artillery is found useful in almost any kind of country, for many special purposes. In view of this, it is often called "pack artillery" instead of "mountain artillery," and the name seems a more appropriate one.

Heavy battery

Our heavy batteries are organized the same as light. They are simply light batteries magnified in every way —size and weight of matériel, and number of men and horses. They have the advantages of high power and long range, and the corresponding disadvantages of inferior mobility and limited ammunition supply.

Higher units

The battery organization we have always had, in some form not fundamentally different from what we have now. With higher tactical units we had little experience prior to 1862. In the Civil War both sides began with an artillery that had very little organization beyond the battery. Batteries were assigned to infantry brigades or even regiments, without any fixed system; and occasionally, in the very beginning, we find guns forming integral parts of infantry regiments—a faint suggestion of the "battalion guns."

The first attempt at organization on the Federal side was by General McClellan when he took command of the Army of the Potomac. He assigned four batteries to each division, one of the four being from the regular service; the captain of the regular battery was supposed to be chief of artillery of the division, but seems never to have had any well-defined functions. Later, during the Peninsular campaign, he directed that each corps commander withdraw from each of his divisions one-half its batteries, and organize them into a corps reserve. Besides this divisional and corps artillery, he formed an army reserve of eighteen batteries, and a separate siege train.

Civil War organization, Federal

Later on, as new divisions were organized, and artillery had to be provided for them, the army reserve gradually diminished in size, and finally became little more than a central depot or park. By 1863 the divisions had become greatly reduced in strength, and in most cases all the divisional artillery was withdrawn and consolidated into a corps artillery brigade. Thus, in the Gettysburg campaign, each corps had its brigade of from four to eight batteries; the cavalry corps had two brigades, aggregating nine batteries; and the army reserve consisted of twenty-one batteries, organized into five brigades. On account of the lack of field officers, most of the brigades were commanded by captains.

The Confederates had a similar experience with their artillery. In the Peninsula, their army reserve artillery was organized into battalions of from three to five batteries, and was all under one head; but in only about half of the divisions was there any organization beyond the battery. In the others the individual battery commanders reported directly to the division or even the brigade commanders. Later in the war the Confederates evolved a very good artillery system, the tactical unit being the battalion of from four to six batteries. The corps artillery consisted of two battalions under a chief, the divisional

Confederate

artillery of one battalion. There was no army reserve.

At the end of the Civil War all tactical organization disappeared. Occasional attempts were made to revive it, but nothing of permanent value was done until 1901, when field batteries were grouped into battalions. This system was further developed by the reorganization of 1907.

Present organization

At present our tactical grouping of batteries is the same for all classes of artillery. Three batteries constitute a battalion, under a major, and two battalions a regiment under a colonel. In peace the regiment is the highest unit, but in war it is proposed to organize brigades of two regiments each. A brigade of light or mountain artillery is assigned to each infantry division, a regiment of horse artillery to each cavalry division, and to each field army an amount of heavy artillery suited to its particular requirements. This gives, in the infantry division, about 3⅓ guns per thousand rifles.

Since the adoption of this organization, conditions have been changed so as to make certain alterations seem desirable, as explained in the report of the Chief of Staff for 1912. It is proposed to increase the strength of infantry regiments from 1500 to 2000; this would make the proportion of guns to rifles only about 2½ per thousand, which is altogether too small. It has become apparent, moreover, that uniform organization for all classes of artillery is inappropriate, and that, whatever the regimental organization may be, the armament should include some proportion of howitzers. The War Department has therefore adopted, as a part of its plan for a general army reorganization, the following organization for artillery.

The field artillery regiment would consist of three battalions, two of three gun-batteries each and one of two howitzer-batteries. The brigade would still consist of two regiments.' The armament of the gun battalions would be as at present. In each brigade, one of the two howitzer battalions would have the light howitzer, and the other the intermediate howitzer with eight-horse teams, which would give all batteries about the same mobility. The proportion of guns to infantry would be about the same as it is now, 3⅓ per thousand.

Proposed reorganization

For horse artillery, the number of guns alloted to the cavalry division is considered sufficient, but the organization is awkward. There being three cavalry brigades in the division, it is proposed to organize the six horse batteries into three two-battery battalions.

The three-battery battalions are considered a trifle unwieldy for heavy guns. It is proposed to cut off one battery, leaving a heavy regiment two battalions of two batteries each, one battalion armed with heavy howitzers, the other with heavy rifles. One such regiment would be the normal allowance for a field army of two or three divisions.

Foreign Organizations.

The German light battery (*fahrende Feldbatterie*) still retains the six-gun organization, although some high authorities, notably Gen. Rohne, have strongly favored a reduction to four guns. Only six caissons are assigned to the battery, the additional ammunition being carried in regimental light columns. Each battery has recently been given a special carriage for the equipment of the battery commander's

Germany

observation station; this is common for heavy batteries, but unusual for light. Three batteries constitute a battalion (*Abteilung*); two battalions and two light ammunition columns, a regiment. Each light column consists of 21 caissons, giving a total ammunition supply in the regiment of 233 rounds per gun. Brigades are permanently organized, of two regiments each.

The old German practice was to assign part of the light guns to the divisions and part to the army corps. In 1870, sending in the corps artillery came to be generally recognized as the sign of energetic action; and it was a current phrase in camp to say, when an officer trumped a trick at whist,—"Ah, he is sending his corps artillery into action." Another standing joke in the Guard Corps was that the corps commander, whenever an important message came in that required his personal action, used to call for "my boots and the corps artillery." But this organization has now been abandoned, and all the light guns are assigned to the divisions. One brigade is alloted to each infantry division, giving 144 guns to the army corps (two divisions, 25,000 infantry) or 5¾ guns per thousand. In each artillery brigade one battalion is armed with light howitzers, the other three with guns.

The horse battery (*reitende Batterie*) has now the same organization as the light, but the battalion (*Abteilung*) has only two batteries. There is no separate regimental organization, the horse artillery battalion, with its own light ammunition column, being assigned in time of peace as a third battalion to a light regiment. These battalions are intended for service with cavalry, and one is allotted to each cavalry division of 3600 sabers. Since, however, the cavalry division is made up of three brigades of two regiments each, the two-battery battalions are recognized as unsuitable, and steps are now being taken to reorganize them into three four-gun batteries.

The heavy field artillery (*schwere Artillerie des Feldheeres*) is manned by foot artillery troops—a corps which is entirely distinct from the field artillery, and which also mans the siege guns when such weapons are required. Batteries are of four guns; the details of organization vary according to armament, which is usually heavy howitzers, but sometimes even heavier mortars. A battalion (called in the foot artillery *Bataillon*, not *Abteilung*) consists of four howitzer or two mortar batteries, and a light ammunition column. Both battalion and battery commanders are provided with observation wagons. The battalions are grouped into regiments for peace-time administration only.

As compensation for the loss of the old corps artillery, each army corps is allotted one battalion of heavy howitzers; exceptionally, one of mortars.

Germany has no mountain artillery, except provisional organizations in the colonies.

France

The French field artillery (*artillerie de campagne*) includes both light, horse, heavy and mountain batteries.

A light battery (*batterie montée*) or horse battery (*batterie à cheval*) has four guns and twelve caissons, and carries 312 rounds of ammunition per gun. A mountain battery (*batterie de montagne*) also has four guns, but its internal organization is necessarily different. The battalion (*groupe*) is now made up of three light or two horse batteries, but it is planned to add a third battery to each horse artillery battalion; mountain batteries, being used for special purposes only, have no regular battalion organization.

France retains both corps and divisional artillery. A corps artillery regiment consists of four *groupes* or battalions, and a divisional regiment of three, so that the normal two-division army corps has thirty batteries, or 120 light guns. Upon mobilization, these batteries furnish certain officers and men, designated beforehand, to form the nucleus for six so-called "reinforcement batteries;" these are assigned to the corps artillery, which is then handled as two independent three-battalion regiments (*fractions*). An effort is made every summer to bring together the details constituting the nucleus for the reinforcement batteries, and give them field and firing practice together.

Each corps, in time of war, is expected to receive some additional reserve units, both infantry and artillery. Not counting these, we see that the normal corps (24,000 infantry) has 120 light guns at least, or 144 if it successfully mobilizes its reinforcement batteries. This works out at 5 or 6 guns per thousand rifles.

In addition to its light guns, the corps will have attached a battery of heavy field artillery (*artillerie lourde d' armée*). The heavy batteries have only two guns in peace, but four in war; each battery has its observation wagon. Organization higher than the battery is not ordinarily provided; when required, as for assignment to headquarters of an army, *groupes* of three batteries, and possibly even regiments of three *groupes* will be formed. These batteries are armed with heavy howitzers, and belong to the field artillery; siege batteries would be taken if required from the foot artillery. This corps consists of 30 coast and 59 fortress batteries; a number of types of gun are available for use in siege operations.

England

The English battery has six guns, except heavy batteries, which have only four. Horse and field batteries are grouped into brigades, corresponding to our battalions; the brigade consists of two horse or three field batteries. Mountain and heavy batteries are not grouped into brigades. Batteries have two caissons per gun, and each brigade has a light ammunition column, making 252 rounds per light gun available in all.

The English "Royal Regiment of Artillery" (R. A.) is not a regiment at all in our sense of the word, but includes the whole artillery arm. It has three branches, Horse (R. H. A.), Field (R. F. A.) and Garrison Artillery (R. G. A.); the last named branch, besides seacoast and fortress companies, furnishes the mountain, heavy and siege batteries.

Horse batteries are designated by letters (doubled after the alphabet is exhausted), and other batteries by numbers, each in its own class. A minor peculiarity to be noted is that the normal rank of a battery commander is major, and of a brigade commander lieutenant colonel.

England, like the United States, has abandoned the army corps organization.* To each infantry division of 10,000 rifles are assigned three brigades of field guns, one brigade of field howitzers and one battery of heavy guns. This gives an unusually large proportion of guns to rifles—7.2 per thousand of field artillery guns, or 7.6 per thousand counting heavy guns. A cavalry division is made up of four brigades of about 1200 sabers each, and has two horse artillery brigades, or four batteries. There is also a peculiar organization known as a mounted brigade, consisting of cavalry and mounted infantry; to each of these is assigned a single horse battery.

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*From newspaper notes on the English forces in the present European war, it would appear that the corps organization has been taken up gain; the details are not yet known.

Russia

The Russian field battery has eight guns, but it is divided into two half-batteries and is habitually handled like a small battalion. The battery is commanded by a lieutenant colonel (there being no majors in the Russian army), and each half-battery by a captain. Three, or sometimes two, batteries form a battalion, and two or three battalions a brigade. Horse and heavy batteries have only six guns; a battalion usually consists of two batteries, although some heavy battalions have three, and there is no brigade organization.

The light guns are all assigned to the divisions. The usual organization provides, in each army corps of about 30,000 rifles, a six-battery brigade for one division and an eight-battery brigade for the other, making 112 light guns in all, or 3.7 per thousand rifles. In addition, each corps has two batteries of heavy howitzers. The cavalry division of two brigades, 3600 sabers, has two horse batteries.

Japan

The Japanese artillery organization is like the German. The battery has six guns, the battalion three batteries, and the regiment two battalions and a light ammunition column. The infantry division, 12,000 men, has only one regiment, 36 guns. There are no army corps, but armies are formed by grouping divisions. To army headquarters is assigned additional artillery, both light and heavy, as desired.

The additional light regiments, in time of peace, are organized into brigades of two or three regiments. The heavy batteries are grouped into battalions of three batteries, and these in turn are grouped into regiments and brigades and attached to certain divisions for administrative purposes. Since the Russian war the heavy artillery has been much increased, and now consists of nineteen battalions; but according to the Japanese mobilization scheme each unit maintains the nucleus of a corresponding reserve unit, so that these 57 heavy batteries would be expanded into about 95, besides depot batteries. Mountain artillery, on the other hand, has been greatly reduced since the war, and does not now form a part of the artillery regularly assigned to divisions.

Holland

The Dutch artillery has recently taken a step which will be watched with interest, and may have an effect upon organization in other and more powerful armies. The War Department became convinced that the six-gun battery was too large a fire unit. The plan of reduction to four guns was considered, but this would have necessitated an increase in the number of batteries, and funds for this were not available. The solution finally adopted was to retain the six-gun battery for all administrative and tactical purposes, but to divide it habitually into two three-gun fire units, one commanded by the captain and the other by the senior lieutenant. Elaborate regulations have been issued, prescribing the equipment and firing methods for these new units; it is yet too early to decide upon the merit of the plan.

CHAPTER III.

MATÉRIEL.

The artillery of all military powers is now armed with what are known as "rapid fire" or "quick firing" guns. This designation is too firmly established to be changed, although it can not be considered as accurately descriptive, since rapidity of fire is not by any means the only, or even the most important, characteristic of the type.

Rapid fire guns

The real distinguishing mark of a rapid fire gun is that its carriage does not move materially in firing; instead, the gun recoils on the carriage (which is sometimes called, for this reason, a "gun recoil"* carriage), and is returned to the firing position by springs or their equivalent. There are a number of other features, some or all of which are found in all rapid fire models; but these are of secondary significance, and are either old ideas which could never be worked out practically before the development of the gun-recoil carriage, or else improvements developed since in the effort to get the best results out of it. For example, it is useless to attach shields to a rigid carriage, for, since the can-

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***The nomenclature here is unsettled and confusing. Referring to the old system various terms are used, such as "rigid carriage," "free recoil," "carriage recoil," "recoil on the ground." Among the expressions characterizing the new are "gun recoil," "non-recoil," "recoil on the carriage."**

noneers have to stand clear to avoid the recoil, they cannot take advantage of them. Mechanism for traversing the piece on its carriage is unnecessary with the rigid system, but becomes necessary as soon as we adopt a carriage that remains more or less firmly anchored to the ground. Fixed ammunition, and instruments for indirect laying, are not essentially a part of either a rigid or a gun-recoil system; they are sometimes used with the former, and occasionally—but rarely—omitted from the latter; but they have their full value only in rapid fire matériel.

The easiest, as well as the most useful, way of examining into the characteristics of rapid fire artillery matériel is to study concrete types; and so, without further theoretical discussion, we will pass to a description, as little technical as possible, of the guns and equipment adopted in our own service.

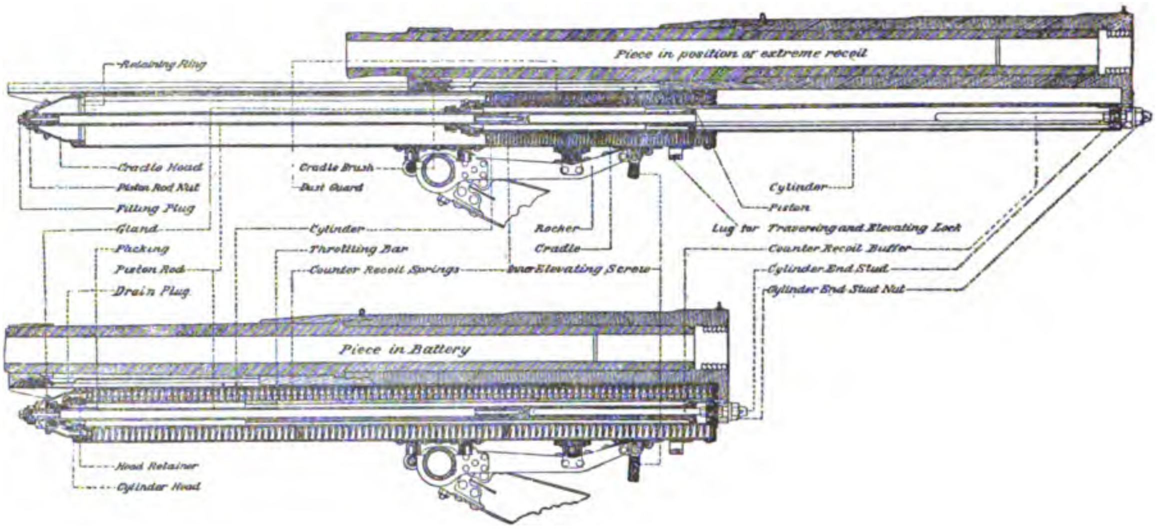
The Light Field Gun.

American matériel—light gun

Our light field gun has a caliber of three inches, and fires a fifteen-pound projectile. It is of nickel steel, and consists essentially of a tube with jacket shrunk on. It has no trunnions, but clips are formed on its under surface, which fit over the guide rails of the cradle upon which it rests, in such a way as to permit longitudinal motion only.

Recoil cylinder

Inside the cradle, which is tubular, is hydraulic gear for controlling recoil. This gear consists of a cylinder, about six feet long and a trifle less than three inches in outside diameter, whose rear end is bolted to a lug projecting downward from the breech of the gun, and a piston whose



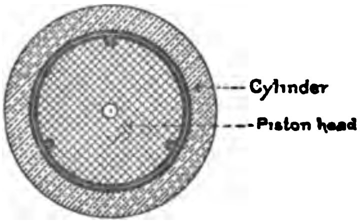
Recoil Controlling Mechanism

FIGURE 1.

rod passes through a stuffing box in the forward end of the cylinder and is connected to the front of the cradle. Upon firing, the cylinder recoils with the gun, the piston remaining stationary; the resistance caused by the passage of the oil contained in the cylinder through notches cut in the piston head controls the recoil, which is limited to 45 inches.

Throttling bars

To check the force of recoil gradually and easily, longitudinal ribs, called throttling bars, of uniform width but varying height, are formed on the interior wall of the cylinder. These lie in the notches of the piston head, and gradually close them during recoil; thus the resistance is constantly increased until the piece is brought to rest. A diagrammatic representation of these parts is seen in Fig. 2.



Transverse Section-Piston head

Longitudinal Section-Throttling bar.

FIGURE 2.

Helical springs, assembled in the cradle around the cylinder, absorb enough of the energy of recoil to return

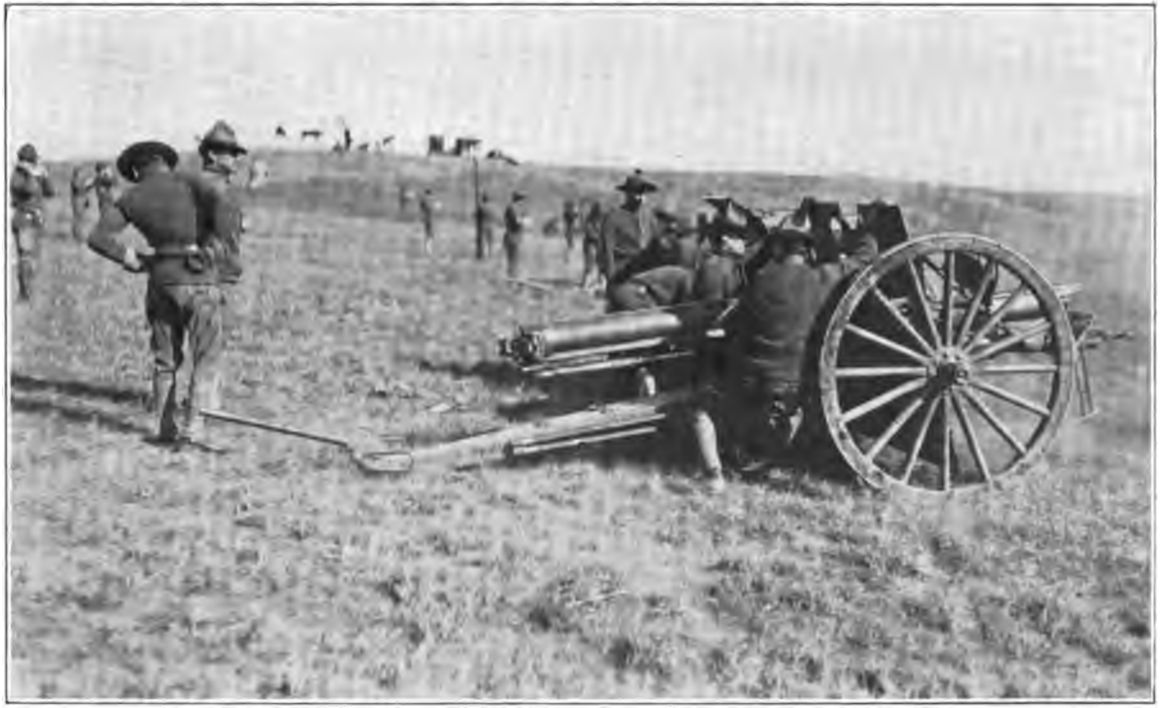


PLATE 1.

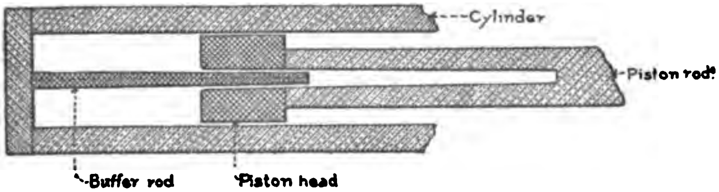
THREE-INCH GUN AT FULL RECOIL

the gun promptly to its firing position. The springs are assembled under an initial compression of about 500 pounds, and will return the piece to battery even at maximum elevation. The motion is very quick; some twenty unaimed shots per minute are possible.

Spring return

The springs being thus powerful, some means must be provided for checking the counter-recoil with the least possible shock, so as not to injure the parts or unnecessarily derange the aim. This is accomplished by fitting a slightly tapered rod, about 18 inches long, to the inside of the rear cylinder end; this fits, with very slight clearance, into a hole bored axially in the piston rod. As the piece returns to battery, liquid is caught in this cup, and can escape only through the small clearance, thus forming a cushion. Fig. 3 shows the principle of this device.

Counter recoil buffer



Longitudinal Section, counter-recoil Buffer

FIGURE 3.

The cradle rests upon a platform called the rocker, upon which it is pivoted so as to have a motion in azimuth of four degrees on each side of the normal. This rocker is journaled on the axle, about which it may be rotated; it thus forms an intermediate part, connecting the upper carriage, already described, with the lower car-

Traversing and elevating gear

riage, which consists of the wheels, axle, trail and elevating device. The last-named part is a double screw arrangement, the outer screw connected to the trail and the inner to the breech end of the rocker. When the carriage is standing on level ground, the maximum elevation is 15 degrees; maximum depression, 5 degrees; height of axis of the piece, 41 inches.

To relieve the traversing and elevating gear from strain while travelling, the cradle can be locked to the trail.

Trail spade

The energy of recoil, though taken up and distributed in the manner described, must of course come ultimately to the lower carriage. To prevent the carriage from being moved out of place, a spade is provided at the end of the trail, which, on ordinary ground, is buried at the first shot, and thereafter holds the carriage stationary. The ordinary road brake may be used to lock the wheels, and so relieve the pressure on the spade.

Shields

For the protection of the personnel against small-arm and shrapnel bullets, a shield is provided. It consists of three plates, apron, main and top shields, which fold together for travelling. When extended, the bottom of the apron is 5 inches, and the top of the top shield 62 inches, above the ground. Before acceptance, each plate is tested by firing at it at a range of 100 yards, with the service rifle and ammunition; the plate must not be penetrated, cracked, broken or materially deformed. Each accepted plate bears the scar of this test in the form of a slight indentation.

Seats are attached to the trail, for the gunner and firing number when the piece is unlimbered. Axle seats are also provided for cannoneers when travelling. Under the axle seats are four steel tubes, each intended to carry one round of ammunition, for emergency use only.

Breech mechanism

The breech mechanism is of the slotted screw type, and is opened or closed by a single motion of the operating lever. The first part of this motion rotates and unlocks the block, and latches it to the block carrier; the remainder swings block and carrier clear of the breech recess. Suitable safety devices are provided to prevent accidental opening.

An extractor, very much like that in a rifle, engages the head of the cartridge case and throws it clear when the block is opened. A firing pin with appropriate mechanism is enclosed in the block, with proper safety devices to prevent firing before the block is fully closed. The trigger handle is on the right side of the piece, and is attached to a non-recoiling part of the carriage; it engages the firing mechanism only when the piece is "in battery"—that is, when counter-recoil is complete. A lanyard may be attached if it is desired to stand clear of the carriage in firing, as, for example, when the trail spade has not yet taken hold of the ground. The firing mechanism is "double action," so that in case of a missfire a second trial may be made without touching the operating lever.

The laying apparatus consists of two instruments:—the sight, mounted on the left side, and the range quadrant, on the right side, of the piece unlimbered. In use, both instruments are fixed to non-recoiling parts of the carriage; when travelling, they are carried in leather-lined, sheet steel cases, supported upon springs and attached to the main shield.

Sights

The sight is telescopic, of peculiar form. Light entering at the reflector opening is reflected directly downward through a tube, and then again reflected ninety degrees to the eye-piece. The vertical distance between the eye-piece and reflector opening is such that when a man's eye is at the former, the latter is above the top of his head. Cross-hairs are provided in the plane of the image, so that when the sight is directed upon any object the cross appears to be drawn upon the object itself, as in the transit.

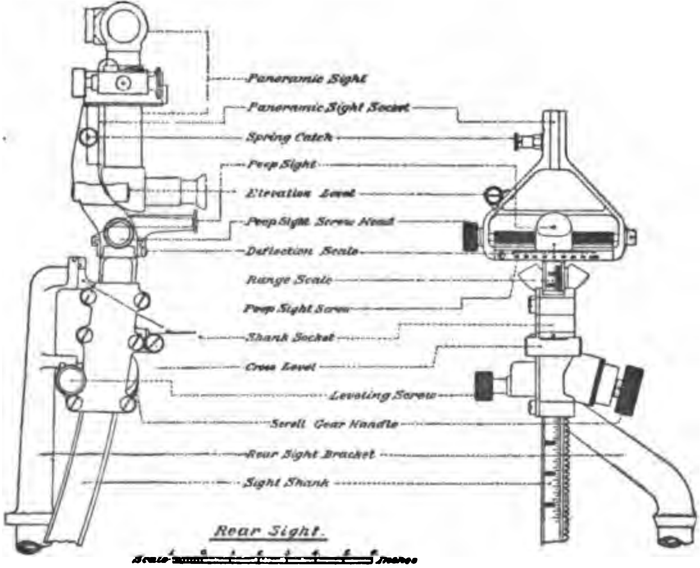


FIGURE 4.

The sight is supported upon a shank, curved to the arc of a circle, fitting into a bracket riveted to the cradle; by means of this shank, with suitable gearing, proper elevation may be given the sight for different ranges. A cross level also is provided, to correct for difference in the level of the wheels when in position. A sighting port is, of course, cut in the shield.

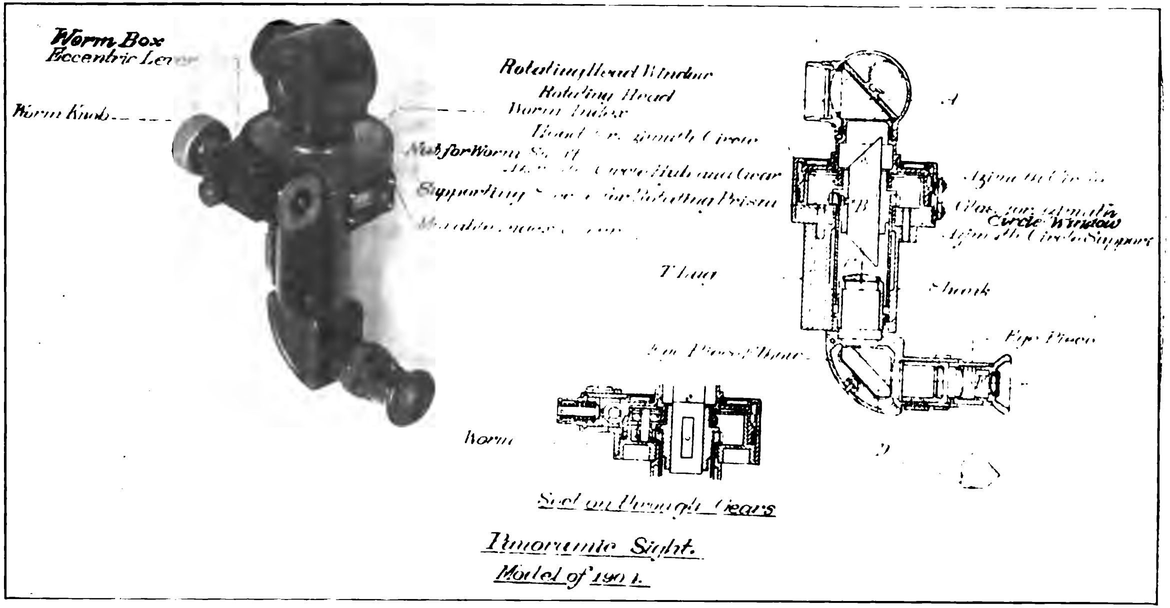


PLATE 2.

THE PANORAMIC SIGHT.

An ordinary peep-sight is supported upon the same shank; it is used in connection with a front sight on the forward end of the cradle. The distance between front and rear sights is about 37 inches; this, consequently, is the radius used in striking the arc of the rear sight shank. The height of the line of sight above the ground is, for the peep-sight, 45 inches when the gun is at zero elevation. With the telescopic sight the reflector opening is about 7 inches higher.

The telescopic sight is so constructed that, while the eye-piece remains fixed, the upper part, containing the reflector, can be turned through a whole circle, and an object situated even in the direct rear of the gun may be observed through it; from this peculiarity it is called the "panoramic" sight. A very ingenious optical contrivance makes the image in the eye-piece always erect, in whatever direction the reflector opening faces. The value of this arrangement will be seen when the subject of indirect laying is discussed.

The "mil"

The graduation of the sight limb is not in degrees and minutes, but in "mils." This unit is theoretically that angle, something over three minutes, whose natural tangent is 0.001. Thus if, firing at a given range, the deflection set off on the sight be changed by one mil, the point of fall of the projectile at the next shot will, theoretically, be moved laterally $\frac{1}{1000}$ of the range. The number of mils in a complete circle is approximately 6400, and the graduation of the sight limb is arranged accordingly. The exact number would evidently be 6283 and a fraction ($2 \times 3.1416 \times 1000$); but the error caused by using the more convenient even number is so slight as to be negligible.

With this sight and direct laying, the proper elevation and deflection may be given the gun by the gunner alone, who is seated on the left trail seat with the elevating and traversing gear at hand. If desired, however, aiming for direction alone may be left to the gunner, and the elevation given by cannoneer No. 1, who sits on the right trail seat with the range quadrant in front of him, and has control of a second elevating crank.

Quadrant

The quadrant is a special form of clinometer. The sight measures vertical angles not from the horizontal, but from the line joining piece and target. All range tables necessarily give sight elevations. In order to use the quadrant, therefore, it is necessary to correct the sight elevation by adding to it or subtracting from it another angle, called the "angle of site,"—that is, the angle between the horizontal and the line joining piece and target. The result is what is called the "quadrant elevation" for the range and target in question; it evidently varies, not only with the range, but also with the difference in level of gun and target. Fig. 5 shows the different angles mentioned.

Sight and quadrant elevation

The quadrant is so constructed as to give automatically this algebraic sum, or "quadrant elevation." The angle of site is measured, and the clinometer scale set accordingly. This scale is graduated in mils, and employs the same principle of continuous graduation as the sight limb; the reading when level is not zero, but 300. Hence any desired elevation or depression is absolutely designated by its number alone, the number being less than 300 for a target below the gun, and greater for one above; and even the most inexperienced cannoneer is not likely to make the mistake of setting off an elevation when a depression was ordered, or *vice versa*.

The clinometer scale being set for angle of site, the range dial is set for the range. The result of these two operations is that the instrument mechanically combines the two angles—angle of site and sight elevation—and that a level borne by the quadrant is set at an angle to the axis of the piece equal to their algebraic sum. The gun is now elevated or depressed until the level bubble is centered; it is then correctly laid in elevation.

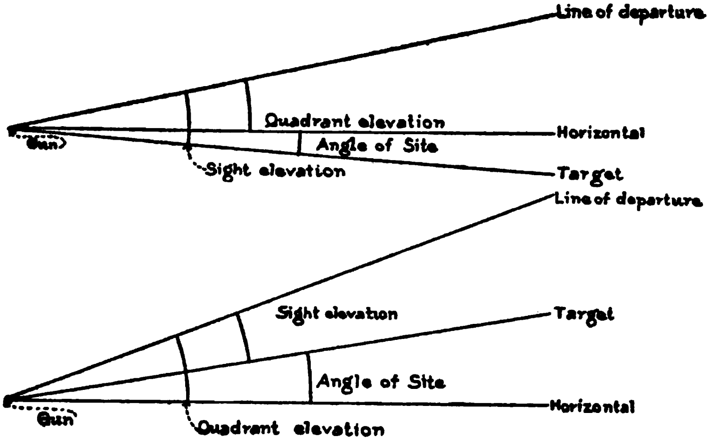


FIGURE 5.

Wheels

Much consideration has been given to the proper size of the wheels. Large wheels give easier draft, and also greater road clearance; on the other hand, they increase the weight and turning radius and necessitate a longer trail to give stability in firing—for the shock of discharge tends to raise the wheels from the ground, rotating the whole carriage about the end of the trail. The wheel finally adopted has a diameter of 56 inches; the width of tire is 3 inches, and the track 60 inches. Wheels are interchangeable for all vehicles in the battery.

Limber

The limber is all steel, except pole and wheels. Gun and caisson limbers are identical. Space is provided in the chest for 39 rounds of ammunition, packed horizontally, bases to the rear—three rows of thirteen each, the cases fitting into tubes set in vertical partitions. Three of these tubes, however, are not ordinarily used for ammunition, but are to contain oil cans, one for kerosene, one for lubricating and one for cylinder oil. Thus there are forty rounds with the gun itself, counting the four under the axle seats.

Weights

The gun and carriage complete, with shield and four rounds of ammunition, weigh 2520 pounds; the limber, with all equipment and full chest, weighs 1740 pounds; thus the total weight behind the gun team is 4260 pounds, or about 700 pounds per horse. This is a trifle heavy, since it seems to be generally accepted that 650 pounds per horse is enough, but several other countries have found the same difficulty in keeping down the weight. Our excess is due largely to two causes—our high wheels, and the quantity of ammunition carried.

Caisson

The caisson body carries a much larger chest than the limber, containing 70 rounds of ammunition, packed in five rows of fourteen each. This makes the caisson considerably heavier than the gun, the weight behind the team, when fully loaded and equipped, being 4560 pounds. It is proposed to reduce the size of the chest and the quantity of ammunition carried, building future caissons with only four instead of five rows of ammunition compartments.

The front of the chest is of armor plate, the same as is used in the gun shield. An apron shield of the same plate is hinged under the axle, so as to be lowered in action and raised when travelling. When lowered it reaches to within 5.5 inches of the ground. The rear wall of the chest forms the door; it opens upward, swinging 120 degrees, in which position it catches and holds. It is of armor plate like the shield, and is intended to deflect bullets clearing the chest.

Battery and store wagons

The battery wagon is constructed like a caisson, except that its chest is arranged to carry blacksmiths', carpenters' and saddlers' tool kits and materials. Its limber contains the forge and equipment. The store wagon is similarly constructed, its body being fitted to carry repair materials and spare parts for the battery, and the limber to carry instruments and signal equipment. In practice, this limber is generally used on one of the caissons of the fifth section, in order to have the instruments always with the firing battery, and an ammunition limber is used on the store wagon.

Ammunition.

The ammunition includes common shrapnel, high explosive shrapnel and high explosive shell. The projectiles all have the same weight, fifteen pounds, but not the same length, the shell being slightly longer than the others; the ammunition chests are so constructed as to hold either length securely. The proportion of shell to be carried is not definitely fixed, and will naturally be decided in any particular campaign by the kind of service to be expected.

Common shrapnel

The common shrapnel now issued has a steel case with solid base. It is closed by a steel head, screwed in, which carries a combination time and percussion fuze. A light bursting charge of black powder is placed in the base, covered by a steel diaphragm; a tube connects the powder chamber with the fuze, and a stopper of dry gun cotton in the tube holds the powder in place and insures its ignition from the fuze. The filling consists of about 250 half-inch lead balls, held in place by a resinous matrix, which also serves to produce smoke when the shrapnel bursts, thus facilitating observation.

The weakest cross section is where the head is attached. On explosion the head is blown off, the case usually remaining intact, and the case then acts like a short shot gun, projecting the bullets to the front with an added velocity of 275 foot seconds.

Shell

The shell is of steel, and contains a little less than a pound of high explosive. It is burst by a detonating percussion fuze, screwed into the base. A lead and copper base cover prevents leakage of powder gas into the interior through the screw threads.

High explosive shrapnel

The high explosive shrapnel is expected to supersede the shell. It is like a shrapnel with a very small high explosive shell in its head, and with a high explosive matrix. When burst by the time element of its combination fuze, the shock is not powerful enough to detonate the matrix, which burns quietly like an ordinary matrix, and the projectile acts as a shrapnel. If the percussion element acts, it detonates the high explosive in the head, which in turn detonates the matrix, and the projectile acts as a shell.

The combination fuze, in either form of shrapnel, is set for time by turning a disc in the head. A device for setting is attached to each caisson, and smaller ones, for use in the hand, are carried for emergencies. The fuze setter has two scales, a range scale and a "corrector" for adjusting height of burst. The corrector scale is graduated in mils, the reading 30 corresponding, with normally burning fuzes, to the normal height of burst, 3 mils. The arbitrary number 27 was added to obviate the possibility of requiring a negative setting. The two scales being set as directed, the cannoneer has only to insert the point of the projectile, carrying the fuze, into the instrument, and turn it as far as it will go. The fuze is then set to burn the requisite number of seconds before exploding.

Fuze setting

The instrument is so graduated that when the corrector is set at 27 (zero plus the arbitrary number), this number of seconds is equal to the full time of flight for the range set on the range scale. Setting the corrector at any number above this changes the relative position of the parts in such a way that the time setting will be less than the time of flight; that is, the higher the corrector setting the shorter the burning time of the fuze, and consequently the higher the burst.

The propelling charge is about 24 ounces of nitrocellulose powder; the exact quantity varies with the lots of powder, being adjusted to give the standard muzzle velocity of 1700 foot seconds. A round complete, with its brass case, weighs 18.8 pounds.

Powder charge

Observation Equipment.

An important accessory of the battery is the battery commander's telescope. The type now in use is somewhat similar in form to the panoramic sight, but larger and more powerful, and mounted on a tripod. It is intended for measuring deflections and angles of site, and for observing fire. For quicker and rougher measurement of angles a short rule is issued, graduated in mils and provided with a cord by means of which it is held at a fixed distance from the eye. Many other schemes for quick measurement of angles are in use, such as determining the angular breadth of the hand held at arm's length, and applying this as a unit of measurement; the average man's hand held in this manner covers about 150 mils.

Telescope

The present telescope is not satisfactory, and is soon to be replaced by an entirely new pattern. Being constructed on the principle of a transit, it requires careful levelling before reading angles of site. This levelling takes time, and the instrument is hard to keep in adjustment. It is not specially adapted for observation of fire, being only a monocular and of no exceptional grade. It is, besides, too heavy and awkward to handle. The new telescope is modeled after a German instrument, two patterns of which are shown in Plate 3. It is to be a prismatic binocular; like the sights, its tubes are twice bent at right angles, but they are much longer and the glasses more powerful. They are mounted so that both tubes may be set vertical, so as to look over a wall, or horizontal, so that one looks out on each side of a tree or other vertical cover. In the latter position, the two "eyes" are some two feet apart, so that the stereoscopic effect is considerable, and the instrument is

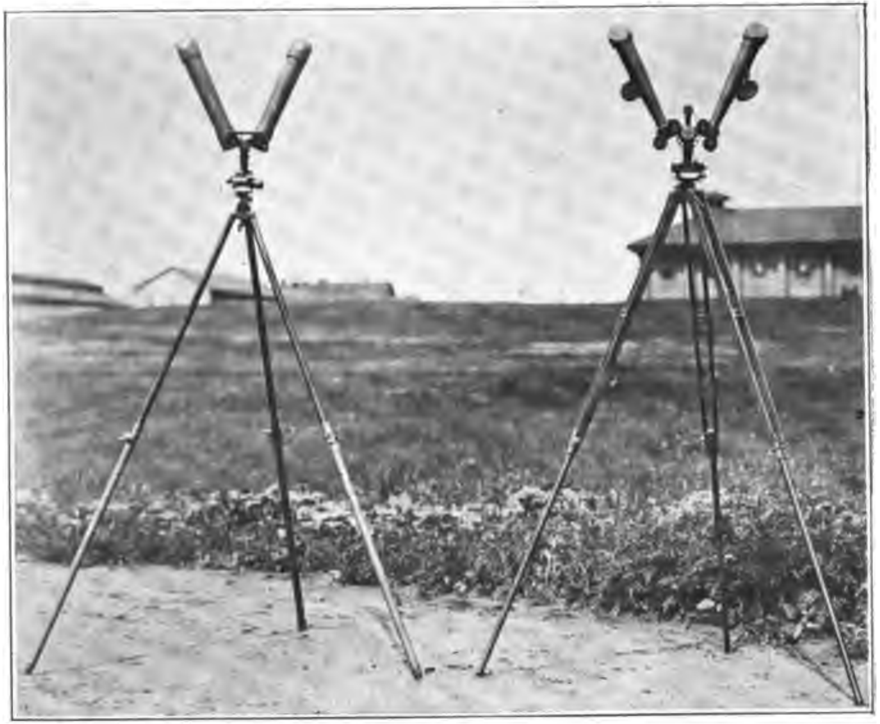


PLATE 3.
THE SCISSORS TELESCOPE.

excellently adapted for observation. The angle of site measuring device is independent of the level of the instrument, so that these measurements are very quickly made. From the peculiar mounting of its tubes, this instrument is colloquially called the "scissors" telescope.

Observation ladders

There has been much experimentation abroad, and some in this country, with a view of providing some kind of elevated observation station. Numerous devices have been tried, and although their adoption adds to the complication of equipment their utility seems to justify it. For heavy batteries especially something of this kind seems necessary. Besides several forms of folding ladder, domestic and foreign, there are two or three types of collapsible mast, one of which, the Fontana, has given some satisfaction in this country. There is also an ingenious German instrument, well adapted to the use of heavy batteries, which is essentially a very large scissors telescope, which permits the observer to look over a high mask; it has been neatly described as a hybrid, "by a scissors telescope out of a Fontana mast."

As has been said in Chapter II, the 3-inch gun is used by both light and horse batteries, the horse batteries saving weight by carrying their limbers habitually empty. The usual practice abroad is to have a different and lighter gun for horse artillery.

Other Guns.

The heavy gun (Plate 4) is a 60-pounder, 4.7″ caliber. Its construction is much the same as that of the 3″ gun, but larger and heavier in every way. Instead of having the counter-recoil springs assembled around the hydraulic cylinder, they are placed in two separate spring cylinders, one on each side of the hydraulic cylinder. The recoil is long, about six feet, and it would be very cumbersome to use springs of this length; hence in each spring cylinder three spring columns are placed, telescoping one inside the other. The forward end of each column is connected to the rear of the one inside it by a stirrup arrangment, so that the springs work tandem, and have a long stroke with a short assembled length.

American heavy gun

The gun is so long, 11 feet 3 inches, that a heavy strain is brought upon the pointing mechanism in travelling, and means are provided for locking the breech to the trail, much as in the light gun; this, however, is relied upon only when moving short distances. For a long move, it is desired to give greater rigidity and also to reduce the inequality in distribution of load, for the gun wheels normally carry much more weight than the limber wheels. Hence means are provided for unlocking the gun from the recoil mechanism, drawing it to the rear, and engaging the breech lug in a travelling lock placed well back on the trail.

The gun limber carries no ammunition chest, and is merely a rolling support for the trail. The caisson limber and body chests are identical, carrying 28 rounds each. Both shell and shrapnel are provided, the latter containing about 700 half-inch lead balls. The battery has four guns and eight caissons, besides battery wagon and forge limber, store wagon and limber, of the same general type as in the light battery.

The shields and the pointing and laying apparatus are similar to those of the 3″ gun. The wheels are 60″ in diameter, with a 5″ tire. The weight of gun and

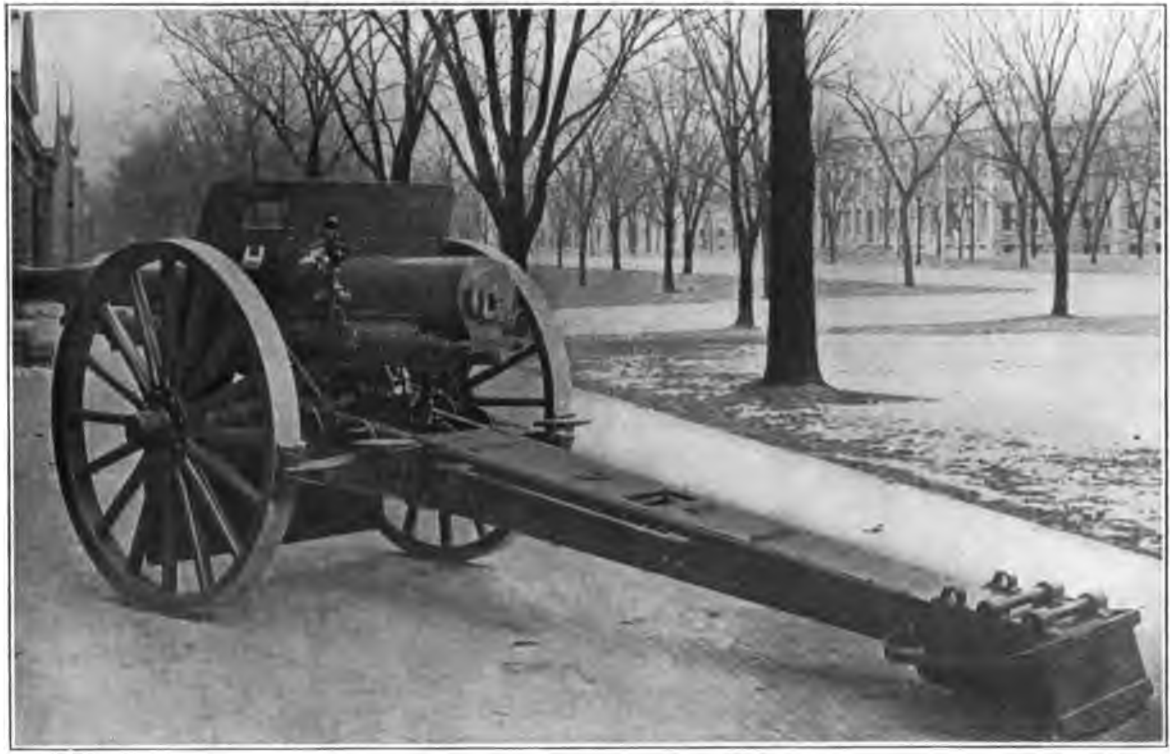


Plate 4.

THE 4 7-INCH HEAVY FIELD GUN.

carriage in firing position is 7400 pounds; weight behind the teams (eight horses) 8750 pounds. With the piece in its normal position the weight on the gun wheels is 7100 pounds and on the limber wheels 1650; with the piece drawn back to travelling position, the figures become 6100 and 2650. The caisson with limber, fully equipped and loaded, weighs 8200 pounds, the load falling nearly equally on the wheels. The maximum elevation obtainable on the carriage is 15°, giving about 7500 yards range; by sinking the trail about 11,000 may be obtained.

Howitzers

A howitzer differs from a gun in several very important respects. The most notable peculiarity, structurally, is that the carriage must be designed with with a view to much greater elevations than a gun carriage. This necessitates some modifications in the recoil mechanism—there must be the long recoil, to give stability when the howitzer is fired as a gun, with low elevation, and there must be some device to avoid striking the breech on the ground when firing at high elevations.

Constant and variable recoil

There are two systems in general use for accomplishing this, one using a constant long recoil and the other a variable recoil. In the former system the piece is supported on trunnions, which are placed, not near the center of gravity, but under the breech, or even on an extension in rear of it. Thus, when the piece is elevated the breech is not brought nearer the ground, and, the trail being properly cut out, there is room for a full recoil. The great objection to this is that the weight of the piece is not balanced. To permit of giving elevation without great labor and undue strain on the mechanism, the chase has to be supported by springs, which are likely to sag and permit the muzzle to drop; and the cross strains on the traversing gear are greater. Besides, the center of gravity of the piece and carriage in action is higher, and the stability is reduced.

The other system has some form of valve, geared to the piece, which automatically throttles the oil passages in the cylinder as the piece is elevated. By this plan, full recoil is permitted at low elevations, where the horizontal component of the force of recoil predominates and the tendency to shift the carriage is greatest; the recoil shortens as the horizontal component grows less and the vertical greater. The objection to this system is the complication involved in the valves and gearing.

Of the two systems, we have chosen the second, variable recoil. The oil passes the piston, not through notches as in the guns, but through a separate channel or "by-pass;" the valve, geared to the piece, regulates the flow of oil from the cylinder to the by-pass.

Variable charge

Another peculiarity of the howitzer is its use of variable powder charges. This makes it possible, within limits, to select at any range such angles of departure and fall as are most appropriate to the position and target. The projectiles are not fixed in the cartridge cases, but carried separately; the powder charge is in several sections, so that by removing one or more sections the muzzle velocity is reduced by a definite amount. A separate range table is computed for each charge, and a multiple graduation provided on the sight shanks.

Our howitzers use three zones of fire. These are not the same, of course, in the different calibers, but

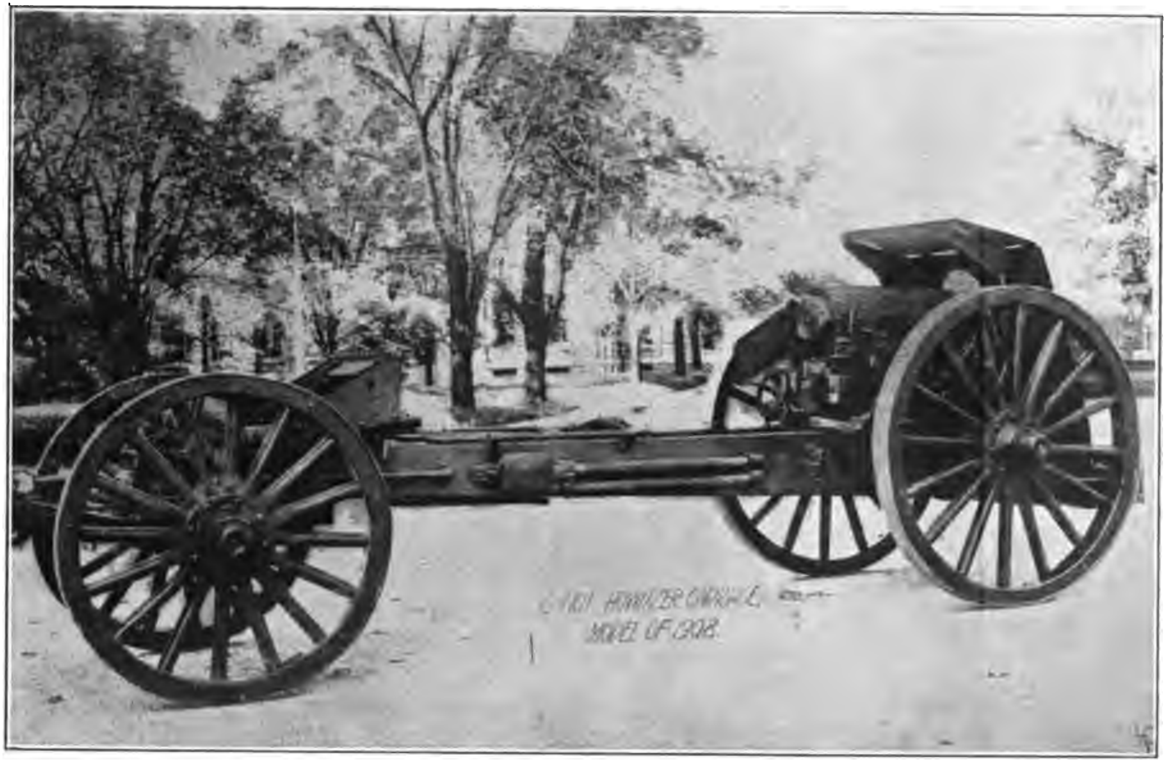


PLATE 5.
THE 6-INCH FIELD HOWITZER

roughly the first zone, reached by the smallest charge, is from zero to about 2000 yards, the second from zero to 3000 or 4000, and the third, or full charge zone, from zero to 6000 or 7000 yards. In each case, the maximum elevation is 40°. Thus, for example, with the 6″ howitzer, range 2000 can be reached with full charge and 8° 14′ elevation; one section of the powder charge being removed, 16° 19′ elevation is required; with the smallest charge, the elevation is 36° 11′.

American field howitzers

Three field howitzers have been adopted,—light (3.8″), intermediate (4.7″) and heavy (6″), all of the same general type. The purpose for which each is intended has been explained in Chapter II. The batteries are organized on the same plan as gun batteries. The weights behind the teams, for the light and heavy howitzers, are much the same as for the guns of the same class. The 4.7″ howitzer, with six horses, has nearly the same weight per horse as the 6″ howitzer with eight; with eight horses, it is nearly the same as the 3.8″ with six. The projectile weights are respectively 30, 60 and 120 pounds.

Our mountain artillery is now armed with a 75 mm. (2.95″) gun, of English manufacture. Its recoil on the carriage is short, only 14 inches; the recoil mechanism is on the same principles as above described, but different in detail, and much simpler and less delicate. The wheels are 36″ in diameter, and the track is 32″. In firing, the wheels may be attached to the trail by ropes to prevent their revolving; this arrangement, together with a trail spade, reduces, but does not entirely prevent, recoil on the ground. The projectile weighs

American mountain guns

12½ pounds, the muzzle velocity is 920 foot seconds, and the maximum range about 4000 yards. Four pack mules are required for each piece, one carrying the gun, one the cradle with attachments, one the trail with attachments, and one the wheels and axle. The loads weigh from 340 to 350 pounds, including harness; the loads of ammunition mules are somewhat lighter. The carriages have recently been modified to permit the use of panoramic sights, and the methods of fire are now identical with those used in light batteries.

While this has been a very serviceable and satisfactory gun, it is not of the rapid fire type, since it does not remain fixed in position while firing. The Ordnance Department has for some years been trying to develop a satisfactory rapid fire mountain howitzer; a design has now been adopted, and one battery issued to the service, but it has not yet had a long enough service trial to determine its value. The new howitzer has full 3″ caliber, and long recoil on the carriage. It being thus a true rapid fire gun, shields can be used, and have been provided; an additional mule in the gun team is required to carry them. Like the other howitzers, it has a variable charge, using three zones of fire. The projectile is fixed in the case for transport, but is readily removable for altering charges. The maximum elevation is 40°, giving ranges of 1800, 3300 and 5500 yards according to zone. The recoil is variable from 36″ at zero elevation to 12″ at maximum.

Foreign Matériel.

Having now gone over in some detail one typical light field gun, and noted the general characteristics of the other pieces in use in our service, it will be of

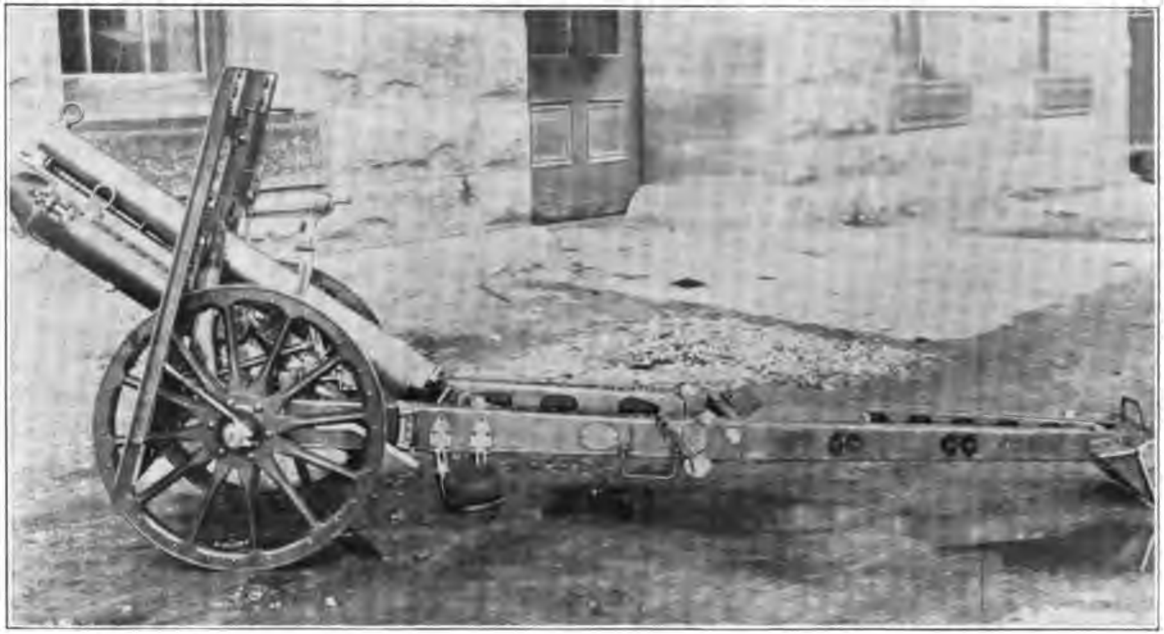


PLATE 6.

THE 3-INCH MOUNTAIN HOWITZER.

interest to examine briefly the matériel of some of the principal foreign nations.*

France

The French gun, Model 1897, was the first rapid fire field gun adopted for regular service. It represents a somewhat different type from those above described, the essential distinctions being in the counter-recoil and traversing mechanisms.

The recoil system consists of three cylinders; two contain liquid, the third air under a compression of 12 atmospheres. When the gun is fired, the hydraulic cylinders act as already described, to check the recoil at about 42 inches, but the return is accomplished by the pneumatic cylinder, the air contained therein having been still further compressed by the motion of recoil. The gun is not perfectly stable in firing; to make it so it is necessary to anchor it by means of wheel shoes.

The hydro-pneumatic mechanism is said to work very satisfactorily. As compared with springs, it has both advantages and disadvantages. It seems to be favored in France, not only by the State but by private manufacturers; in other countries the spring system is generally preferred.

The traversing device differs radically from ours; instead of the gun being pivoted on the lower carriage, the entire carriage may be slid along the axle, pivoting on the end of the trail. By this arrangement, the force of recoil is always in line with the trail, not, as with us, often at an angle with it; but the radius of rotation is long, necessitating a great deal of lateral motion to give a small change of direction, which in turn necessitates cutting out part of the shield. Besides, the spade or the wheels or both have to shift slightly when the piece is traversed, so that the gear does not work easily.

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*Only field artillery pieces are here considered. The very heavy guns so constantly mentioned in reports of the present war, being siege matériel, are outside the sphere of this book.

The gun itself is of nickel steel, caliber 75 mm., or 2.95 inches, length 36 calibers, weight of projectile nearly 16 pounds. The breech mechanism is the Deport eccentric screw. The breech block is cylindrical, some 6 inches in diameter; on one side of the axis it is cut out so as to leave a hole the size of the bore of the gun. This block is placed with its axis parallel to that of the gun, but lower, and so secured that it is capable of rotation only. When it is turned so that the cut-out side is up, the breech is open, for loading or ejection of an empty cartridge case; when it is turned 180 degrees, the breech is closed and the firing pin is opposite the primer.

The piece has an "independent line of sight"; that is, the elevating system consists of two independent parts. One moves the gun and its recoil controlling attachments with reference to the upper part of the carriage, and is controlled by a crank on the right side of the piece; the other moves the whole upper carriage, to which is attached the sighting apparatus, and is operated by a hand wheel on the left side. The elevation corresponding to the range is given by the firing number, on the right. When indirect laying is resorted to a level on the left side is set by the laying number to the angle of site, and the bubble centered by means of the hand wheel.

To lay in direction, an instrument called the "collimator" is used. This has not the advantage of including a telescope, but it does away with the front sight, using instead an optical line of sight contained in the instrument itself. The collimator is mounted on the left side of the carriage, 46 inches from the ground, and a lengthening piece is provided for the standard by which it may be raised higher if desired; it is capable of being turned about a vertical axis, and has a limb graduated in mils.

There are two separate shields, one on each side of the gun, the space at the top between them being unprotected. The ammunition is fixed, and includes shrapnel and high explosive shell. The weight behind the teams is about 4100 pounds. The muzzle velocity is 1650 foot seconds. The gun limber holds 24 rounds, caisson and limber 96.

A new gun, Model 1913, has just been adopted for the horse artillery, very similar to this but lighter, and taking the same projectile with a reduced powder charge. It is made by the Schneider works.

France has no light howitzer. The adoption of such a piece is being strongly urged, but against equally strong opposition. As a half measure, it has been very seriously proposed to issue flat plates, which may be attached to the projectile heads to increase air resistance when it is desired to use curved fire.

The heavy batteries are armed with the Rimailho howitzer, caliber 155 mm., or slightly over 6″. This piece fires an 89 pound shrapnel or a 95 pound shell, and has a range of about 7000 yards. It has long recoil on the carriage, of constant length (about 1½ meters) regardless of elevation; semi-automatic eccentric screw breech mechanism; shields and laying instruments similar to those of the light artillery; and traverse on the axle. Although a powerful and a heavy gun, it has great mobility, for the piece itself may be removed from the firing carriage and transported separately. This may sound complicated, but it is claimed that the operation takes only two minutes. To make the transfer, the travelling carriage is run up in rear of the firing carriage and the piece drawn back or forward on rails. The carriage limbered weighs about 5700 pounds, and the gun on its travelling carriage 6200; these weights can easily be handled at slow gaits by six-horse teams, and if, as reported, eight-horse teams are to be substituted, the mobility would become almost that of a light battery.

Germany

Germany was slow to accept the rapid fire gun. When it was finally decided to re-arm the artillery, considerations of economy prevented the purchase of entirely new guns. The present light gun, Model 1906, is the old 1896 gun, modified, and mounted on a new rapid fire carriage. It is a steel 15-pounder, caliber 77 mm. or a little over 3″, length 27.3 calibers. The trunnions have been removed, clips added, to slide on the cradle guides, and an attachment at the breech end provided to connect the gun and the recoil buffer.

The breech mechanism is of the Ehrhardt single motion pattern; instead of a screw block, a wedge is used, sliding laterally in a recess cut through the breech end of the gun. The firing handle is on the piece itself, not on a non-recoiling part of the carriage, and so is pulled out of the firer's hand by the recoil.

The recoil arrangements are on the same principle as our own; the length of recoil is 44 inches. Elevating and traversing gears also are similar to ours, but there appears to be no lock for them when travelling.

Model '96 wheels, 53.3 inches in diameter, are retained. The height of the axis of the piece is 40 inches. The shield is in three parts, somewhat like ours.

Telescopic sights are provided, and a separate device, not telescopic, for giving direction in indirect laying. The adoption of panoramic sights is under consideration.

The muzzle velocity is low,—1525 foot seconds. Each gun limber carries 36 rounds, each caisson with limber 88. The weight behind the gun team, limber filled, is about 4000 pounds.

The light howitzer is a 10.5 cm. (4.2″) Krupp 31-pounder. Its weight is about the same as that of the 77 mm. gun. Panoramic sights are used.

Two heavy pieces are in service, a howitzer and a mortar. No heavy rifle is ordinarily taken into the field, but a 10 cm. (4″) gun is available to be brought up if required. This is an excellent modern gun, and although classed as a siege piece has very good mobility.

The heavy howitzer has a caliber of 15 cm., or slightly under 6″. The piece in firing position weighs 4800 pounds. It fires only shell, of 87 pounds weight, and has a range of about 7000 yards. The weight behind the team is 5800 pounds. This is a true heavy field piece, being able to march with infantry under any ordinary conditions, and to fire from the ground without any special platform. With trained men, it may be unlimbered and prepared for action in five minutes.

The mortar is more properly a siege piece. Its caliber is 21 cm., or 8.3″. Like the French Rimailho howitzer, it is transported, not on its firing carriage, but separately. Even so it is very awkward; it is generally confined to the roads, and a battalion of infantry is habitually assigned to each mortar battalion—not as escort, for the personnel of the heavy batteries are armed with rifles, and are numerous enough to take care of themselves as a rule, but to assist in getting over bad places in the roads and in constructing cover.

England

The English felt the need of heavy guns very keenly in South Africa, where the Boers opposed 15.5 cm. Creusot guns to their field pieces. To supplement the few heavy guns that the Army could provide, the Navy furnished a number of 4.7″ and 12-pounder guns. These were placed upon improvised carriages, and served by seamen. Being heavy and awkward, the carriages were drawn by long teams of oxen, but in spite of all difficulties they managed to keep up with the mobile columns, and rendered excellent service. The 12-pounders, in spite of their light projectiles, were high power guns, and entitled to rank with heavy artillery.

After the war, mindful of these lessons, the English began to specialize in heavy artillery. In rearming with rapid fire guns, they chose an 18 ½-pounder instead of the usual 15. For horse batteries they have a 12 ½-pounder of similar construction. The calibers are respectively 3.3″ and 3″, muzzle velocities 1610 and 1658 foot seconds, weights behind the gun teams 4500 and 3600 pounds. Gun limbers hold 24 rounds, caisson limbers 28 and caisson bodies 48. Both guns are of true rapid fire construction, with spring return and pivot traverse. They are provided with telescopic sights and apparatus for indirect laying, but not with panoramic sights. The line of sight is independent, as in the French gun. Curiously enough, while adopting all the other features of indirect laying devices, the English have refused to accept the mil as their unit of angular measure. All their instruments are still graduated in degrees and minutes, so that their methods of fire are a trifle cumbersome.

The field howitzer is a 37-pounder, 4.6″ caliber, with variable recoil. The English use no true heavy howitzer, but only a 60-pounder rifle. This is a good shooting gun, but heavy, the weight behind the team being about 10,000 pounds.

Russia

Russia had very few true rapid fire guns in the Japanese war. A few Model 1903 guns went to Manchuria, but most of the artillery was armed with older types.

The 1903 field gun is of nickel steel; the caliber is 3″, length 30 calibers, weight of projectile a little under 15 pounds. The breech mechanism is of the single motion slotted screw type. The piece has a 40″ recoil with spring return, and traverses on the axle like the French piece. Its most noteworthy characteristic is its high muzzle velocity—1930 foot seconds, higher than any other field gun. This has its advantages, but also equally marked disadvantages. The gun limber carries 36 rounds, caisson with limber 88. The weight behind the team is 4300 pounds.

A new horse artillery gun, Model 1913, made by Schneider, has just been introduced. It has the same caliber as the field gun, but differs in almost all other particulars. It is provided with the regular Schneider hydro-pneumatic recoil mechanism, and is a very light and compact gun, very similar to the new French horse artillery gun.

Russia has three types of heavy guns. The usual one, regularily assigned to the army corps, is officially known as a mortar, but is more accurately a heavy howitzer, of 19 cm. or 7.5″ caliber. In addition, there are 16 batteries of 6″ 100-pounder howitzers, and 8 of 5.2″ 40-pounder rifles.

Japan

Japan has entirely rearmed since the war with Russia. Her field piece in that war was of old pattern and low power. The present field gun is a 75 mm. 14-pounder, of modified Krupp design and Japanese manufacture, with spring return and pivot traverse. The muzzle velocity is 1700 foot seconds. The ammunition in the gun limber is 36 rounds, in caisson with limber 100; weight behind the gun team 3800 pounds.

The heavy armament consists of both guns and howitzers. The gun is the Arisaka 10.5 cm., model 1905, which carries a 40-pound projectile; it is a rapid fire piece, with a maximum range of about 13,000 yards, although the sights are graduated only to 8500. The howitzers are of Krupp manufacture, or Krupp design and Japanese construction; there is a 12 cm. 44-pounder and a 15 cm. 80-pounder.

Italy

A gun recently adopted by Italy for a part of her field artillery deserves comment, on account of several entirely new features. It was designed by Col. Deport, late of the French service, the designer of the breech mechanism and other features of the French gun. The trail is split, and opens out when the piece is unlimbered, so as to give two widely separated points of support in rear instead of only one. This permits a very wide field of fire horizontally, without deranging the laying; also it gives room for downward recoil, and so permits the use of very high elevations. Through ingenious, but somewhat complicated gear, advantage is taken of these possibilities; traverse is on a pivot, with very wide limits on each side, and there is

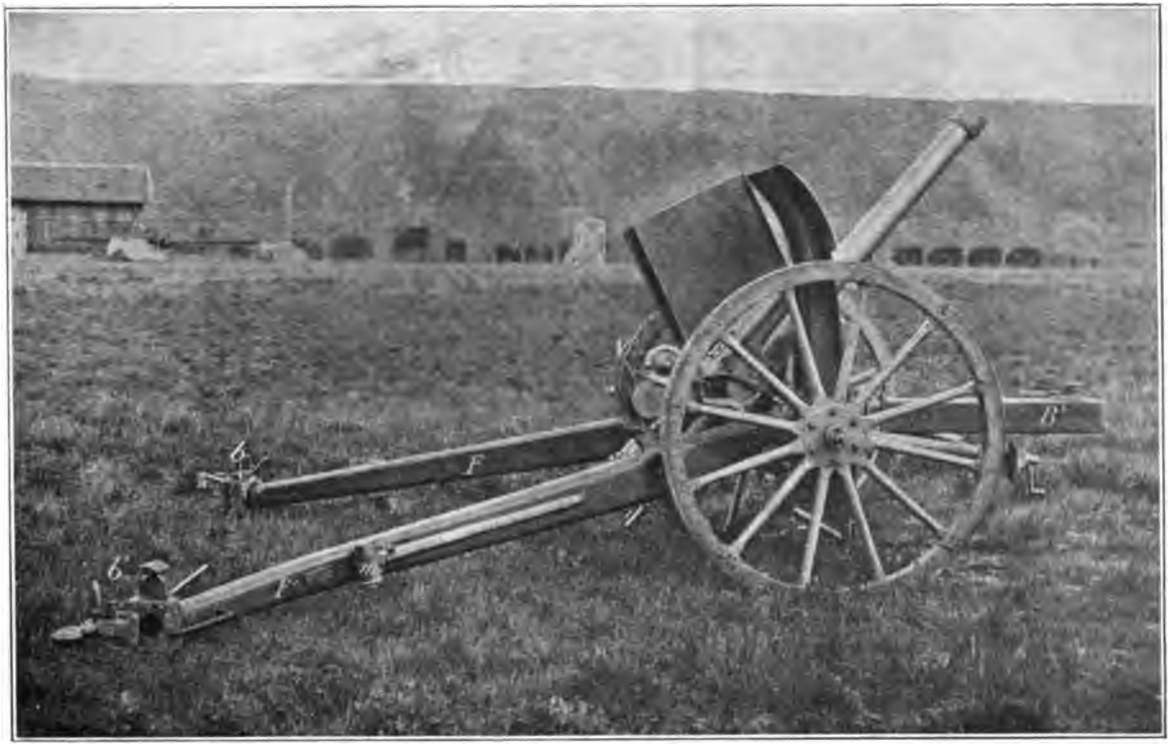

Plate 7

THE DEPORT FIELD GUN—MAXIMUM ELEVATION

a variable recoil system of novel design. The gun itself is so mounted as to have the minimum of connection with the recoil devices; hence heating of the gun has little effect upon other parts, and in comparative tests this gun has held a decided advantage over others in long continued fire. A piece of this type was recently tested in this country, and certain features of it made a very favorable impression.

CHAPTER IV.

AMMUNITION SUPPLY.

Statement of problem

The problem of ammunition supply consists in providing each gun with some definite initial quantity of ammunition, and then replacing expenditures promptly so that this amount may always be on hand at the front.

The first question that arises, therefore, is how many rounds should be allotted to this initial supply. It should evidently be large enough to give reasonable assurance that guns in action will not run out of ammunition, but on the other hand it should not be unnecessarily large, or the batteries will be overloaded and their combat trains unwieldy.

To answer this question we must first consider such data as can be collected as to actual expenditure, especially in recent wars. Incidentally, we must inquire how other armies have solved the problem, for in case of conflict with them relative as well as absolute quantities would count.

Ammunition expenditure

Investigation of the first point is not easy. Accurate reports of ammunition expenditure are hard to find, and when we do get a reliable statement for one unit we have no means of telling how this compares with others. We may find that the *n*th Battalion of the *n*th Field Artillery at the battle of A expended x rounds per gun in y hours, at point B in the general defensive line. This sounds like very definite evidence, but a whole list of questions remains unanswered. How much of the time were the batteries actually firing? Did all of them have the same target? If not, did one fire more than the others? How was the ammunition in the combat trains distributed? Did any battery run entirely out of ammunition? Again, we can not tell how this expenditure compared with that of other battalions, even if by great good luck we happen to know the total expenditure for the division or corps; and we do not know how much of the ammunition reported expended was actually fired, and how much was lost or abandoned in changing position. And if by chance we find that the battalion was chiefly engaged with artillery, and try to make a comparison between this reported expenditure and that of the opposing guns, we find that we have a circumstantial account for a battalion on the other side that was in action on the other flank, but none for the batteries that were engaged with the nth.

Nevertheless, in spite of these difficulties, recorded examples are the only thing we have to guide us, and we must do the best we can with them. At least the difficulty is much less than with infantry expenditures. The number of guns and of tactical units is smaller; the round of ammunition is larger and more valuable, and more account is taken of its expenditure; and reports are more often made by the expending units, the batteries. No attempt will be made here to go deeply into this matter, but only a few examples will be given; these are taken from various sources, but chiefly from Balck's "Tactics" and from the Records of our own Civil

War. They refer to ordinary field batteries only, and not to any of the special types.

1813.—Battle of Leipzig.—Average for the Austrian guns 199 rounds in three days, or 66 per gun per day.

1863.—Battle of Gettysburg.—Federal average for the 320 guns in action, 102 rounds per gun in three days, or 34 per gun per day. Greatest expenditure reported by any one battery, 1380 rounds in three days, by Battery "G", 4th U. S. Artillery, an average of 77 rounds per gun per day.

The Confederate reports are incomplete, but the expenditure appears to have been about 100 rounds in the three days per gun engaged. The greatest expenditure reported by one battery was 882 rounds for four guns, or 73 per gun per day.

Examples

1866.—Greatest expenditure in one day by a Prussian battery, 180 rounds per gun, at Blumenau; by an Austrian battery, 217 per gun, at Königgrätz. The Prussian average at Königgrätz was 69 rounds per gun; the Austrian, 29.

1870.—Vionville.—Prussian average, 90 rounds per gun; one battery fired 194, and 35 per cent of them fired more than 100.

Gravelotte—St. Privat.—The Prussian average was 55 rounds per gun; 16 per cent of the batteries fired over 100, and the Guard Corps averaged 94 per gun. The French average was 90 per gun.

1899.—One English battery at Magersfontein fired 208 rounds per gun, three others over 160 per gun.

1904.—At Tashihchiao the 2d Battery of the 9th East Siberian Rifle Division fired 522 rounds per gun; this is the greatest expenditure on record. The 1st Battery of the 9th Infantry Division almost equalled it at

Mukden, where it fired 504 per gun in one day. At Liao Yang the sixteen batteries of the 1st and 3d Siberian Corps averaged 422 rounds per gun in two days, and at the Sha-ho four and a half batteries of the 35th Division 315 per gun in the same time. At Liao Yang the 2d Battery of the 9th Infantry Division expended 413 rounds per gun in one day; while on the same day the 5th Battery of the same division expended only 6 per gun.

Initial supply

From these figures we see that the ammunition expenditure has increased rapidly of late years, so that expenditures have been known to reach 500 rounds per gun per day. It is of course unnecessary and undesirable to provide any such amount of ammunition for all batteries at all times, but it would seem that a light battery is not properly prepared for a day's fight with less than half this quantity, say 250 rounds, immediately available.

Foreign organizations

So much for the absolute requirement. The next question is how other countries have solved the first problem—how many rounds go with the fighting troops and how they are carried. In all countries the firing batteries themselves carry a certain quantity of ammunition, corresponding to that in the infantryman's belt; in all countries there is some kind of combat train, and some kind of ammunition train to connect combat trains with a source of supply. But here the similarity ceases, and details vary widely. Enough instances will be cited to illustrate the most usual types of organization;* data are for light field batteries unless otherwise stated.

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*See (for Germany) the Field Service Regulations: (France) Aide-Mémoire de l'Officier d'État-Major, Vade-Mecum de l'Officier d'État-Major: (England) Organization Expeditionary Force, War Establishments, 1910–11; Army Annual 1913.

Germany

In Germany each gun in action has beside it a caisson body containing 52 shrapnel, and on the ground in rear the contents of the caisson limber, 36 shrapnel. The 36 shrapnel in the gun limber are usually not taken out, but remain as a reserve in case of change of position; they are, however, close at hand, so that the gun has available 124 shrapnel. In addition, the store wagon limber contains 36 shell, making the total rounds per gun 130. The immediate reserve is in the regimental light ammunition columns, which carry 352 shrapnel and 264 shell per battery, or about 103 rounds per gun, making 233 in the regiment.

France

The French firing battery has six caisson bodies, containing 108 rounds of shrapnel per gun. Adding to this what is in the gun and caisson limbers of the firing battery gives 168 shrapnel per gun. The battery combat trains are habitually consolidated by battalion; each consists of six caissons, containing 108 shrapnel and 36 shell per gun, making a total of 312 rounds per gun.

England

In an English battery one caisson is placed beside each gun; it is not unlimbered, but the teams are unhitched and taken to the rear. Each gun thus has 76 rounds plus 24 in the gun limber, or 100; the battery has an extra caisson per gun in its combat train, bringing up the supply to 176 rounds, and the ammunition column of the brigade, or battalion as we should call it, contains 202 more, making a total of 378 rounds per gun.

Ammunition columns

It is hardly necessary to carry this phase of the investigation farther. The next subject for inquiry is how the supply at the front is to be maintained. It is necessary to decide how many rounds shall be carried with the mobile forces for this purpose, and how this supply shall be carried and administered.

Germany

In Germany the ammunition columns are under the direct orders of the corps commander. Normally a corps has four infantry and eight artillery ammunition columns, which vary somewhat according to the type of the vehicle used, but average 30 wagons and 200 men. They are treated in all respects as company units, are divided into platoons and sections, and are grouped into *abteilungen* (or what might be called battalions) of two infantry and four artillery columns each. Each heavy howitzer battalion has its own ammunition columns, eight in number, of 17 caissons each, which are attached to ammunition battalions as ordered. When the corps is together one ammunition battalion is usually kept near the troops, to supply the combat trains, and the other a day's march in rear to act as a connecting link between the advanced echelon and the depot. When the corps is divided the corps commander gives special instructions for the assignment of ammunition columns.

The total capacity of the combined artillery ammunition columns is 206 rounds per light gun, which makes the supply within the corps amount to 439 rounds per gun.

Reserve infantry divisions are not permanently assigned to corps. Each has its own infantry and artillery ammunition trains, which, instead of receiving their orders directly from the division commmander, form a part of the artillery command.

In France the whole ammunition supply of the corps is in the hands of the general commanding the artillery, who is a member of the corps headquarters staff. Under him it is administered by the colonel commanding the artillery park. The actual unit of supply is the ammunition section, which, for artillery, consists of 20 caissons. These are grouped in two echelons, and handled in much the same manner as in Germany. There is also a third or heavy echelon for artillery, consisting of ordinary wagons carrying ammunition in boxes. The total artillery ammunition in the corps park is 267 rounds per gun, which makes the total in the corps 579 rounds per gun.

France

England having no corps organization, the ammunition trains proper are assigned to the divisions; they are in two echelons, a divisional ammunition column with horse transport and a divisional ammunition park with motor transport.

England

We come finally to our own service—what has been done and what proposed.

We have preferred the plan of keeping all the first-line ammunition in battery combat trains rather than organizing battalion or regimental ammunition columns. This seems a more flexible system. We habitually march our combat trains consolidated by battalion or regiment, so that the battalion or regimental commander can easily equalize supply within his own command; but they do not constitute a separate administrative unit, and they automatically rejoin when the reason for consolidation ceases. Even when consolidated they are always in touch with their own units, and superior officers need never think of them or give them orders unless there is reason for altering the natural course of events.

American system: combat trains

The first line ammunition would seem, then, to be satisfactorily provided for. Behind this there is more uncertainty. Our old Field Service Regulations provided for a division ammunition train of five wagon companies, three for infantry and two for artillery ammunition. This train was calculated to carry 106 rounds for each light gun, making the total supply in the division 464 per gun. This organization was unsatisfactory and incomplete. It was regularly made up of escort wagons, so that its movements away from the roads were hampered; it provided no reserve of men, horses and matériel. No provision was made for organization and command of the trains, other than to say that they would be commanded by artillery officers assisted by infantry and cavalry officers; the regulations did not specify how many officers there should be nor what their duties were, and it was evident that they were to be taken from combatant units. No rules were laid down to govern these unfortunate officers in handling their unwieldy and unorganized commands.

Ammunition trains, old

Two years ago, when the General Staff formulated propositions for a permanent divisional organization, the matter of a real ammunition service was taken up. With a view to bringing it into closer relations with combatant troops it was proposed to entrust the service entirely to the artillery, instead of to the Quartermaster's Corps. This brought the matter into direct relation with the contemplated changes in artillery organization, already outlined in Chapter II.

Alterations recommended

It having been decided that the infantry regiment should have more rifles, it followed that the artillery regiment should have more guns. It was desired at the same time to introduce into the artillery armament a certain proportion of howitzers. Both these requirements, and also the ammunition problem, were provided for by proposing a three-battalion organization for the divisional artillery regiments—two three-battery gun battalions and one two-battery howitzer battalion. The third battery of the howitzer battalion might then be maintained in skeleton only, giving in each divisional artillery brigade ten officers and about thirty enlisted men to form the nucleus of the ammunition service in war.

Concerning the proper functions of the ammunition service, the report of the General Staff committee says:*

Operation of trains

"The function of the column is to receive ammunition from the line of communications troops and transfer it to the combat trains. * * * The distance to be covered in making this transfer may vary very considerably. The average distance to be traversed may be assumed as one-half day's march; this on the assumption that the advance supply depot will be located one day's march in rear of the combatant troops and that the line of communications troops will feed sub-depots for each division a half day's march farther on. * * * The first portion of the travel from the divisional sub-base toward the front will be on some already existing road, or on one which will have to be immediately blazed out for all the divisional supply trains. On approaching the combatant troops, however, some point on this route will have to be selected from which elements of the column may be sent to the different combat trains. This point may be termed 'the distributing point.' From here the vehicles will have to move often across country to reach the vicinity of the combat trains. Each element will move up to a convenient point to which empty caissons from the combat trains may be sent to be refilled. * *

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*Report Chief of Staff, 1912

"The procedure above outlined seems to be the one that would naturally be followed in the average case. It suggests two things as to the organization and composition of the divisional train:

"1.—That the train should be divided into two echelons; the first to have the duty of transporting ammunition from the distributing point to the various combat trains, the second to have the duty of bringing ammunition up the road to the distributing point.

"2.—That ammunition should be carried in caissons in the first echelon, since all sorts of country may have to be negotiated; while for the second echelon Army wagons or motor trucks should be used, inasmuch as a great saving in men, animals and length of train is thus insured, and inasmuch as wagons or trucks would be entirely suitable for the work to be done.

"The foregoing may be accepted as fundamental considerations determining the organization of division trains. Both echelons should be capable of ready subdivision so that full subdivisions may be moving to the front while empty ones are moving to the rear to be filled. When the line occupied by the division is very extended, it may be desirable at times to split the leading echelon in two and send each part to establish a distributing point for supplying its part of the line.

"The second echelon should have a section comprising the reserve of men, horses, matériel and equipment and also the personnel and equipment for making minor repairs."

The principles here laid down for handling the ammunition service are pretty generally accepted as correct. In spite of variations in organization and in details of operation, we find that all armies work on these general lines.*

The work thus cut out for ammunition trains is by no means light. It is an easy matter to say that each unit turns over its supply to the next one ahead, and replaces it from the next one in rear; but to do it in the field is a different matter from doing it in the office, even if things go smoothly, as they generally do not. As an illustration, Hohenlohe's remarks on the operations of the ammunition columns of the Guard Corps in 1870 are illuminating. Quoting him, Balck† says:

Difficulties of operation

"The first echelon of the ammunition column of the Guard Corps detrained at Kaiserslautern on August 4th, 1870, the 2d Echelon at Mayence on August 8th, 1870. The latter reached Dieulouard on August 17th, after a series of hard marches. On the same day, the 1st Echelon reached Sponville, immediately in rear of the Guard Corps, which was concentrated at Mars-la-Tour. On August 18th the 1st Echelon was posted first near Doncourt, and later between Habonville and Batilly. The 2d Echelon, meantime, had marched via Thiaucourt to the battlefield, a distance of 55 km.

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*Balck, "Taktik," II, 335; Krueger's translation 390. Buat, "L'Artillerie de Campagne," 276. Bethell, "Modern Artillery in the Field," 219.

†Balck, "Taktik," II, 339; Krueger's translation, 395.

"At 2 P. M., August 19th, 1870, all the ammunition columns had been emptied of their contents, had furnished 114 men and 205 horses to replace losses in the batteries, and were in march via Pont-à-Mousson to the field ammunition park at Herny. As they were unable to obtain ammunition here, they continued their march to Saarlouis. After receiving their ammunition they marched westward, learned that the Guard Corps formed part of the Army of the Meuse, found the trail of the corps and hurried after it without specific orders, completing their teams on the way by requisitioning horses. On the 29th, the first of the columns again reached the army corps, and by the 31st all of them had rejoined. The first column had covered 338 km. in ten days, the last 375 km. in twelve days. One day should be deducted from the ten and twelve days respectively, as it was taken up in receiving and packing ammunition. On September 6th, the columns again marched toward Saarlouis, and on the 19th they arrived in front of Paris, having traversed about 540 km. in fourteen days. The columns marched both morning and afternoon, cooked a meal at noon, and went into bivouac each night covered by their own men, who were armed with the rifle."

Considering, then, all the data—the requirements in ammunition, the accepted principles as to its administration, the methods of organization best adapted to carry out these principles, and the matériel to be made available as a nucleus for the organization—the General Staff committee proposed, on mobilization, to expand the two skeleton batteries of the brigade into battalions, one for each echelon of the service, and to place them both under the command of the lieutenant colonel of one of the regiments. Taking the amount of ammunition prescribed for the wagon company trains and dividing it equally between the two echelons, the requirement is found to be for the first echelon 24 caissons 3″ gun, 12 caissons 3.8″ howitzer, 12 caissons 4.7″ howitzer, 54 wagons infantry; for the second echelon 25 wagons 3″ gun, 10 wagons 3.8″ howitzer, 13 wagons 4.7″ howitzer, 54 wagons infantry. The first battalion would therefore consist of three ammunition companies—gun, howitzer and infantry; the second battalion of two train companies—infantry and artillery.

Proposed organization

For an Army ammunition service a similar use could be made of the heavy artillery regiment, and the horse artillery regiment could handle the service for a cavalry division.

To effect these changes, of course, legislation is necessary. As yet, all this is only a dream, and perhaps it may never come true. But even if it does not, it will not be forgotten, and perhaps it may suggest to someone another dream that will come true. Modifications in the organization of the division would of course necessitate corresponding changes in this plan, but the principle can be retained. In any case, the proposed organization has in it the germ of the right kind of ammunition service—one that is more closely connected with the fighting troops than with the supply trains, and that will work automatically, from rear to front, even if detailed orders are not received.

CHAPTER V.

TECHNIQUE OF FIRE.

The firing battery

When a battery goes into action, its first line, or firing battery, consists of the four gun sections and one caisson section, the fifth. The guns are placed at twenty yard intervals, each with its caisson abreast of it, on its left. The two caissons of the fifth section are as near as practicable, normally one on each flank of the battery.

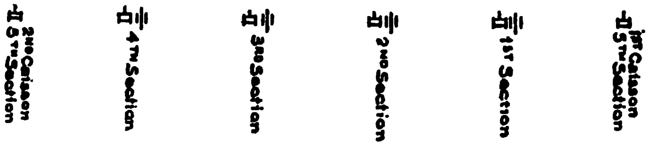

FIGURE 6.

Each piece is served, under the direction of the chief of section, by six men; the gunner (a corporal) and cannoneers Nos. 1 and 2 load, lay and fire the piece, while Nos. 3, 4 and 5, posted behind the caisson, set fuzes and supply ammunition. The chief of each gun pla-

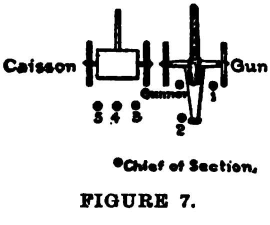

FIGURE 7.

toon supervises the work of his own two pieces; in addition, the senior acts as executive officer, regulating the action of the entire battery when the battery commander leaves the guns for reconnaissance or to observe his fire.

Preparation of fire

Preparation of fire consists, primarily, in determining the settings to be given to the various laying instruments, so that the fire may be directed upon the desired target. Each piece must be laid in direction upon its own part of the target; all must be given the proper elevation for range; and in shrapnel fire the fuzes must be set to give the desired height of burst. These necessary settings are indicated in the firing commands, in an unvarying, stereotyped order, so that each cannoneer always knows when the figures that interest him are coming. Collectively, these figures are known as "firing data."

If the target is in sight, "direct fire" may be used: that is, each gunner individually may be given a particular point of the target to aim at. The firing data are then as follows:

Direct laying

1. Deflection: that is, the lateral allowance set off on the sight to allow for wind and drift.

2. Corrector: the setting on the corrector scale of the fuze-setter, to lengthen or shorten the burning time of the fuze and so lower or raise the burst.

3. Range: to be set off on both the sight and fuze-setter.

If the target cannot be seen, or if it is not desired to use the method of "individual distribution" just described, "indirect laying" and "collective distribution" are resorted to.

First, a common aiming point is selected for all the guns. This may be any conspicuous object, preferably tall and slender and as distant as possible; it may be in any direction from the guns, but it is more convenient when it is not "oblique"—that is, when it is nearly in front or rear or almost exactly on a flank. The angle at each gun between target and aiming point is determined and set off on the deflection scale of the panoramic sight; the gunner lays on the aiming point, and the gun is thus directed upon the target.

Indirect laying

The first problem, then, is to determine the deflection. The theory upon which the methods of determination depend is as follows; some of the practical expedients will be indicated later.

In Fig. 8, the required angle is G. To find this, we must know the three angles B, P and X. The battery commander selects a station (B) near his guns (for preference nearly in prolongation of their line) from which he can see G, P and T, and measures the angle B directly, with his telescope or rule; it will be remembered that the readings of these instruments are not in degrees and minutes, but in mils.

Determination of deflection

The other two angles can not be directly measured, but must be computed. The data for the computation are, the ranges to the target and aiming point, and the distance between the right, or "directing", gun and the battery commander's station.

It has been explained that one mil is the equivalent of a lateral displacement equal to $\frac{1}{1000}$ of the range. Therefore, the range to the target being known or estimated, the value of a mil in linear measure is obtained by simply pointing off three places. Dividing this value into the distance between the directing gun and the battery commander's station will give the value in mils of the angle T; and a repetition of the process, using the range to the aiming point, will give P.

Referring again to the figure, in the triangles BPX and GTX, the angles at X are evidently equal. Hence,

$$B+P=G+T, \text{ or}$$
$$G=B+P-T.$$

The battery commander's station has here been assumed on the right of the battery, and the aiming point in front. It may, however, be demonstrated that the solution holds for any relative positions of the points, provided due regard is paid to the algebraic signs of the quantities used.

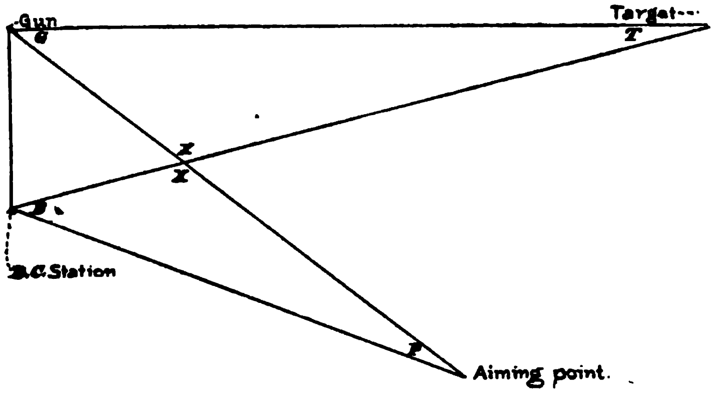

FIGURE 8.

If the direction of the aiming point is very far from the normal to the battery front, or if the battery commander's station is much in front or rear of the line of guns, a correction must be applied to these results. It is evident that the calculation of the angle P, for example, is accurate only if PBG is very nearly a right angle. As the aiming point is moved from this normal position, the angle P diminishes, and becomes zero when the aiming point reaches the prolongation of the line GB. For making this correction a very simple rule of thumb has been devised, so that obliquity of the aiming point causes but little inconvenience.

One important element in the calculation, range, is not certainly known, but only approximated. However, with a battery commander's station near the battery, the error in range estimation must be very great to cause a serious error in the angle.

Various simple methods of making these calculations have been devised, and in the ordinary simple cases they are made very rapidly, in the note book or mentally. Fig. 9 illustrates one of the simplest and handiest of these.

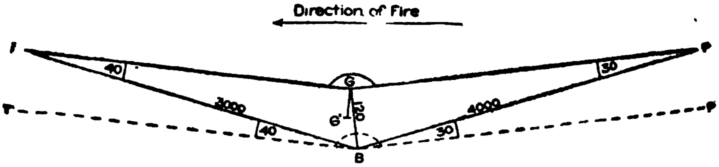

FIGURE 9.

Let GG′ be the line of guns, B the battery commander's station, T the target and P the aiming point. Assume distances from B as follows:—to the right (directing) gun, 120 yards; to the target, 3000 yards; to the aiming point, 4000 yards. Considering first the aiming point, the angle GPB is equal to $\frac{120}{4}=30$ mils; if then we measure off 30 mils to the right (as we look at it) of P, say to P′, the lines GP and BP′ will be parallel. Turning now to the target, the angle GTB is equal to $\frac{120}{3}=40$ mils; measuring off 40 mils to the left, to the point T′, we have GT and BT′ parallel. Hence the angles P′BT′ and PGT are equal. We may measure the former directly, with telescope or rule, and send it to the guns as the deflection for the right piece. As remarked above, the results of the calculations must be corrected for obliquity, if the aiming point is far from the normal, unless the aiming point is so distant and the battery commander's station so near the guns that the angle GPB is negligible.

Deflection difference

A separate deflection might thus be calculated for each piece, so as to bring its line of fire upon the part of the target desired; but since the guns are usually placed at nearly uniform intervals, this is not generally necessary. The deflection settings of the sights are made to increase or diminish from that of the directing gun in arithmetical progression; by changing the common difference of the series, the fire of the four guns may be made to converge upon a single point, or to diverge as much as desired. The lines of fire of the pieces, thus distributed, constitute the "sheaf of fire."

Angle of site

The angle of site (see Fig. 5, Chapter III), has next to be measured. Since the gunner can not, in general, see the target, this can not be done directly, but the angle of site at the battery commander's station can be measured with the telescope and corrected roughly if necessary for difference of level between gun and station. This angle is needed in order that the clinometer of the range quadrant may be set.

The remaining items of the firing data are the same as for direct laying. The complete data for indirect laying include the following figures:

1. Deflection:—to be set off on the sight of the directing gun.

2. Deflection difference:—the amount by which the deflection readings of the four sights are made to vary, in arithmetical progression.

3. Angle of site:—to be set off on the clinometer scale of the quadrant.

4. Corrector:—setting of the corrector scale of the fuze setter, as for direct laying.

5. Range:—to be set off on sight, quadrant and fuze-setter. This setting on the sight does not directly affect the laying, as elevation is given by the quadrant, but it is necessary that it be set approximately, in order that the sight may be level when the piece is elevated.

It is very common to prepare and record more or less complete data for a number of points in the field of fire, so that the battery may be ready to fire promptly upon targets appearing near any of them.

A complete set of data being sent to the guns, the battery is ready to open fire. But as all the data are merely approximations, more or less close, it is not expected that the first shots will be accurately on the target. Hence the battery commander must correct his data by what is called "fire for adjustment."

Adjustment

This is ordinarily done by salvos, either by platoon or battery; occasionally by piece. The method to be adopted depends upon circumstances, such as the nature of the target, the facility of observing the fire, the available supply of ammunition, etc. Either shell, time shrapnel or percussion shrapnel may be used; usually that projectile and fuze are adopted which are intended to be used in the subsequent fire for effect. When time shrapnel is used the first bursts are generally made low, just off the ground, to facilitate observation.

The principle of adjustment is, to establish a "bracket"; that is, to get one group of shots over and one short, and then narrow the limits of error as much as circumstances require and time permits; at the same time distribution and height of burst are observed, and the necessary amount of accuracy in these elements is obtained.

In adjusting by salvos, all the pieces of the battery or platoon are loaded and laid as directed, and fired in turn, beginning at either flank, with an interval of about three seconds between shots to permit of observation of each separately. The battery commander then announces any necessary changes in range and height of burst, and makes such alterations as he sees fit in the distribution of the fire, either shifting the whole sheaf to the right or left by changing the deflection, or opening or closing the lines of fire like the sticks of a fan, by changing the deflection difference.

Correction of data

Corrections may be made by announcing either entirely new settings, or the amount by which the old ones are to be changed. The latter method is the simpler and more rapid, for the officer conducting the fire need not remember any figures but his range, and need not refer to the record of his previous commands. He has only to notice how much out his shot is, and direct the appropriate change in the setting of the proper instrument; the cannoneers make no mental calculations, but simply obey each command separately as it comes to them, using the instruments, so to speak, as calculating machines.

Thus, assume a battery in a concealed position, about to open fire upon one whose guns are partially visible, using time shrapnel with the idea of making the enemy's cannoneers hug their shields and cease or slacken fire. The battery commander's initial commands would be:

Aiming point, church tower to the right rear.

All identify the aiming point.

By battery from the right.

This indicates that the adjustment is to be by battery salvo, commencing with the right gun.

Deflection 2765.

All gunners set the deflection scales of their panoramic sights at the reading ordered.

Diminish by 5.

The gunner of No. 2 piece turns his deflection scale back 5 mils; of No. 3, 10 mils; of No. 4, 15 mils. The readings are now 2765, 2760, 2755, 2750.

Angle of site 295.

This indicates a target slightly below the battery. Each No. 1 cannoneer sets this reading on the clinometer scale of his quadrant.

Corrector 28.

This is the setting which the battery commander estimates, from whatever previous knowledge he may have of the ammunition he is using, is likely to give him bursts just off the ground. Each No. 3 cannoneer sets it on the proper scale of his fuze-setter.

Range 2800.

Gunners set this on their sight shanks; Nos. 1 on their quadrants; Nos. 3 on their fuze-setters. The pieces are loaded and laid.

Commence firing.

The pieces are fired in turn, at the command of the chiefs of section.

Chiefs of platoon keep notes of the data given, for reference to check settings.

The battery commander observes that his directing gun is shooting to the right of the target, and that his shots are too much spread out laterally; all bursts are on graze; two are short of the target, the others doubtful because not in line with the target. He commands:

Add 20.

All gunners turn their deflection scales 20 mils ahead.

Diminish by 3 .

The gunner of No. 2 turns his scale back 3 mils; of No. 3, 6 mils; of No. 4, 9 mils. The settings are now 2785, 2777, 2769, 2761.

Up 5.

Each No. 3 raises his corrector setting 5 mils, making it 33.

Range 3200.

When range is only estimated, and not given by a rangefinder, it is usual to make a change of 400 yards to be sure of getting a bracket. The new range is set as before.

Commence firing.

Another salvo is fired.

Individual correction

This process continues until each gun is firing upon its proper target; until the mean height of burst is convenient for accurate observation; and until a bracket has been obtained and narrowed to the desired degree of accuracy. If, in the course of the firing, one gun is found to be persistently shooting out of its proper place in the sheaf, an individual correction is given it, for example, "No. 3 subtract 4"—which should throw its next shot 4 mils to the right.

Depth of bracket

The depth of bracket to be sought depends upon numerous considerations. The degree of accuracy of the gun itself and of the fuze must be considered—it is useless to try to shoot as close with a bad gun as with a good one. If the target is moving, a rough and rapid adjustment must suffice; if stationary, more deliberation and accuracy are indicated. The projectile to be used and the effect desired also affect the question; a fire for demolition, with shell, requires close adjustment to get direct hits, while time shrapnel, by reason of the dispersion of its bullets, does not. Subject to great variation on account of special circumstances, the following brackets may be considered reasonable:—mounted troops, advancing or retiring, 600 yards; same, moving by the flank, 200 yards; infantry in motion, 200 yards; infantry in position, 100 yards; shell fire for demolition, 50 yards.

Fire for effect

Fire for adjustment merges gradually into fire for effect. It is impossible to draw any hard and fast line between them—one hopes for some effect even from the first shot, and one never ceases to watch for opportunities to get more accurate adjustment during fire for effect. But there is usually a time during the fire when the idea of adjustment ceases to be predominant, and the idea of effect takes its place. This point is reached when the degree of adjustment just described has been secured.

Fire by piece or by salvo now ceases, and there is generally no longer any effort to observe each shot individually for purposes of correction. Instead, fire is by volley—that is, a specified number of rounds fired by each piece independently, as rapidly as consistent with correct laying. The bursts, which have hitherto been kept low to facilitate observation of overs and shorts, are now raised to a mean height of three mils, to give the shrapnel bullets a chance to spread.

This fire is commenced at the short limit of the bracket, or sometimes at a range a little short of that, and the range is increased say 100 yards after each volley until the long limit is reached. The process is repeated as often as necessary, the density of the fire being regulated by the number of rounds fired in each volley. During this fire, ranges that appear to be ineffective are eliminated, and the bracket is narrowed as much as possible.

Another method is "continuous fire." In this, the guns are fired in turn, from one flank to the other, at such interval as may be specified in the command, until "cease firing" is ordered. This method is very well suited, for example, to shell fire for demolition, where direct hits are required and observation of separate shots has to be constant.

"Fire at will" is used for close defense of the guns. Sights are set at 1000 yards and fuzes at zero; each piece fires independently straight to its front, as rapidly as possible, the gunners aiming only roughly. The shrapnel bursting at the muzzle, the bullets are effective up to about 350 yards; the elevation corresponding to 1000 yards is found to give good distribution over the whole beaten zone.

To cover the front of a broad target, the direction of the sheaf may be changed after each volley or series of volleys; or "sweeping fire" may be used. This may be either continuous or by volley. The lines of fire of the pieces are first caused to diverge more or less; the number of rounds to be fired is designated in the command; after each shot the pieces are traversed to the left by one turn of the traversing hand wheel.

It will be seen from what has just been said that the fire of the battery may be held very closely in the hands of the battery commander, and that means have been devised which enable him to manipulate his lines of fire very rapidly and accurately. With practice, the application of these methods becomes instinctive, so that, on observing the error of a shot the proper command to correct it comes to the mind without conscious effort; this facility is easily lost if practice is not constantly kept up, but is quickly regained. Awkward and unusual cases arise at times, which puzzle even the expert, but ordinarily the chief difficulty in the conduct of fire is in rapid and accurate observation. Targets are often indistinct; the puff of smoke of the shrapnel burst is

Observation of fire

dissipated quickly, and drifts away before the slightest breeze; slight irregularities in the ground may hide graze bursts, and it does not take a very great obstacle to obscure an air burst; a burst much out of line with the target or much above it can not be judged for range. The trouble in conducting fire is usually in diagnosing the case, not in treating it.

Granted that fire is well observed and conducted, what effect may be expected from it?

Fire effect

The first question is whether it will reach the target; and this obviously depends upon the form of the trajectory and the accuracy of the matériel. Upon the form of the trajectory, because the projectile must clear both friendly and hostile masks; upon the accuracy of the matériel, because, even if it is theoretically possible to reach the target, practically it is not if it would entail too great an ammunition expenditure.

The following table gives an idea of the shape of the trajectory of our 3″ gun at ordinary ranges:

Range	Angle of departure			Angle of fall			Maximum ordinate	Cone of dispersion, shrapnel balls, angle	
Yards	Deg.	Min.	Mils	Deg.	Min.	Mils	Feet	Deg.	Min.
2000....	2	57	52	4	05	73	93	13	02
2500....	4	02	72	5	48	103	163	13	52
3000....	5	12	92	7	41	137	257	14	28
3500....	6	29	115	9	46	174	378	14	54
4000....	7	54	141	12	05	215	535	15	22
4500....	9	28	168	14	39	260	733	15	48

Take for illustration a range of 3500 yards. The angle of departure is 6° 29′ or 115 mils; hence, even if the mask is so close that the trajectory to it may be considered as a straight line, its height must be under 115 mils—that is, a mask 100 yards away must be less than 11.5 yards or 34.5 feet high, and should be considerably less for safety. The angle of fall is 9° 46′ or 174 mils: if the target is behind cover steeper than this, percussion fire will not reach it. Time fire may, however; if the shrapnel be burst just above the crest of the enemy's cover, we may add to the 9° 46′ half the angle of the cone of dispersion of the shrapnel balls, or 7° 27′, and part of the bullets will reach the target unless the cover is steeper than 17° 13′. If it is steeper, as in well-constructed entrenchments, shrapnel fire can not reach troops taking full advantage of it; all the guns can do then is to make the enemy hug his cover, and so slacken or cease his fire.

Form of trajectory

The next table gives an idea of the accuracy of the fire. These figures are not calculated from the records of proving ground firing, which is done slowly and with care, under the best of conditions, and shows a much greater accuracy. They are from records of actual target practice, and represent the field or service accuracy, considering both men and matériel, which may be expected from an entire battery, under average conditions of weather, matériel and personnel, when firing a considerable number of rounds rapidly. The vertical and range values of the trajectory are based upon analysis of 1926 rounds of shrapnel, fired in 182 problems; the deflection values, upon 1205 rounds of shell and shrapnel, fired in 100

Accuracy of matériel

problems; and the fuze values upon 744 rounds of shrapnel fired in 85 problems.

PROBABILITY TABLE, 3″ FIELD GUN.

(Based upon Student Officers' Firing, Fort Sill, 1913.)

Range	Probable, or 50% Zone (= 2 × probable error.)						
	Trajectory				Fuze	Height of burst	
Yds.	In range, Yds.	Vertical, Yds.	Deflection		In range, Yds.	Yds.	Mils
			Yds.	Mils			
2000....	64	4.6	6.4	3.2	65	6.5	3.3
2500....	63	6.4	8.4	3.4	63	9.1	3.6
3000....	64	8.6	10.6	3.6	63	12.1	4.1
3500....	66	11.4	13.2	3.8	64	15.8	4.6
4000....	71	15.0	16.8	4.3	67	20.7	5.3

Probability of fire

These figures explain many things. For instance, why is it comparatively easy to get a 100 yard bracket with percussion fire, but difficult to narrow it to 50 yards? Column 2 shows us that at 3000 yards the 50% zone for range is 64 yards wide, 32 yards on each side of the center of impact; so that if the actual range were 2970 yards, and our 100-yard bracket 2900—3000, then firing at 2950 we should get so many overs that the bracket might easily be taken to be 2900—2950 instead of 2950—3000. Again, why is it that, even with carefully adjusted bursts averaging the regulation three mils in fire for effect, we get a graze every salvo or two, and a considerable number of high bursts? In the last column we note that the 50% zone for height at 3000 yards is 4.1 mils, or a little over 2 mils on each side of the adjusted 3 mils height. This leaves 25% of the shrapnel bursting less than a mil above the ground, and a calculation based upon probability factors shows that about 16% will be on graze; another 25% will burst more than 5 mils high and 16% more than 6 mils high.

We now have an idea of what the battery can do in reaching its target. It remains to be seen what the effect will be when it does hit.

Shell and shrapnel effect

The field gun is capable of two entirely distinct kinds of fire. Its percussion shell fire is comparable to that of a rifle—it has great effect when it hits, but direct hits are required, and each shot has just one chance. Time shrapnel fire is like shot-gun shooting—each bullet is a comparatively weak projectile, but there are a great many of them.

The shell power of a light or mountain gun is small. The projectile is light, and contains only a small bursting charge. It can demolish thin brick or stone walls, or hastily constructed cover, and can put artillery matériel out of action. For heavy walls or well constructed field works, heavier guns are needed, unless the light guns are prepared to expend very large quantities of ammunition. Permanent fortifications are beyond the power of any field gun, even the heaviest, and some kind of siege gun is required for their effective attack. A slight effect is sometimes obtained upon personnel from flying fragments in percussion shell fire, but this is accidental. Some foreign countries, notably Germany, use a time fuze in their shell; fragments from an air burst are projected in all directions, straight down and even backward, and they hope for effect upon troops close behind entrenchments.

With time shrapnel, from the very nature of the projectile, it is impossible to count upon hitting a particular small target with a particular shot. The projectile is designed for an entirely different purpose, that of covering an area with bullets. From the point of burst the bullets spread in a cone whose apex angle depends upon the relation between the velocities of rotation and translation at the time of burst. This relation being variable, the angle also varies with the range, but we have seen that it is roughly 14° at ordinary ranges. The intersection of this cone with the ground is the beaten area, which evidently varies with the inclination of the trajectory and the height of burst—the shorter the range and the higher the burst the larger the area. It must be noted, however, that if the burst is raised too high (that is, drawn back too far along the trajectory) there will be a greatly increased number of ineffective bullets.

Beaten areas

At 3000 yards the beaten area of a single shrapnel is about 200 yards deep and 20 wide; when several rounds are fired with the same laying, the errors of the gun increase this slightly. But the bullets are not uniformly distributed over this area, being thickest near the axis of the cone, and the bullets farthest from the point of burst are less likely to be effective; hence the area effectively beaten is much smaller, perhaps not much over 20×100 yards. At 4500 yards range the total beaten area has shrunk to about 20×125 yards, with a corresponding decrease in the effectively beaten area.

To get a continuous beaten zone at mid-range, then, the shrapnel should burst about 20 yards apart in deflection and 100 yards apart in range. This gives each shrapnel 2000 square yards in which to distribute its bullets. Supposing each to furnish 200 effective bullets (a high estimate), this gives only one bullet for each ten square yards. Evidently this density of fire is not sufficient to do much damage. It is intensified by firing a number of rounds with the same laying.

If the area to be held under fire is larger then the battery can cover at once (say 100 yards square) the ranges are varied and the sheaf manipulated as described earlier in this chapter. In the figures just quoted we see the reason for the procedure prescribed in sweeping fire. The breadth of the area covered by fire from one gun being from 20 to 25 yards (equal, at 3000 yards, to 7 or 8 mils), it is desired to space successive shots that distance apart. The traversing gear is so designed that one turn of the handwheel gives a change in direction of 8 mils, and in sweeping fire one turn is taken after each shot. Before commencing the fire the guns are laid with sufficient divergence to cover nearly the whole front, and enough rounds are fired in the "sweep" to fill in all the gaps, at the rate of 8 mils per round.

Effect and ammunition expenditure

From figures such as the foregoing one may form a reasonable judgment as to whether it is advisable to fire upon a given target. The effect to be obtained is to be weighed against the amount of ammunition that may be expected to produce it. If the ammunition were unlimited fire might be unrestricted; but it is strictly limited, and the amount available has to be kept in mind. If the target is of minor importance, it is not worth shooting at even if it is a fairly easy one, but even a difficult target must be taken under fire in spite of the great ammunition expenditure involved if the tactical situation requires that a certain effect be produced upon it.

Kinds o effect—casualties

And here it may be noted that the effect required is not necessarily, perhaps not usually, the production of large numbers of casualties. The most effective fire of artillery frequently produces the fewest casualties. This seeming paradox will be referred to again later on; but the point is that if the artillery can make the enemy hug his cover, sit tight and cease firing, it has accomplished a highly useful purpose even if it does not kill many men. That is to say, artillery fire may produce effects either of *destruction* or *neutralization*. In a given tactical situation, the possibilities of the matériel and the ammunition supply determine whether it is worth the cost to attempt to produce effect, and if so what kind of effect to try for.

CHAPTER VI.

MANEUVER: COMMUNICATIONS AND INFORMATION: FIRE DIRECTION.

Hohenlohe says, in his "Letters on Artillery:"—"Judging from my own experiences in war—and you will own that in matters connected with artillery they are fairly numerous—the only movements which are of use in the field are the advance in column of route, deployments, and the advance in line."

The spirit of this remark, if not the remark itself, was in the minds of the writers of our present Drill Regulations.* Drill movements have been limited to what seems an irreducible mimimum, and those that are retained are simplified to the utmost. Paragraph 1 reads:—"The sole reason for the existence of field artillery is its ability to assist the other arms, especially the infantry, upon the field of battle. The degree to which the field artillery prepares itself to render this assistance is, then, the only measure of its training. No refinements of drill ground instruction or other minor details must be allowed to obscure this definite object or to impede progress toward its attainment." This idea is plainly in evidence throughout the book.

Maneuver

It is unnecessary for present purposes to go into the details of battery instruction. For those who wish to do so the drill book itself is the best source of information. But we have hitherto considered the battery simply as a stationary firing machine. Before we can proceed to a discussion of artillery tactics, we must first see how this stationary machine is made mobile; and next how, the mobile battery having been brought into relations with others, the fire of all is directed so as to be capable of a tactical application.

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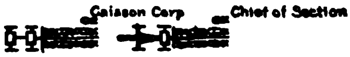
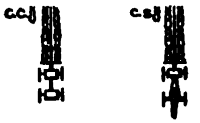
*Drill Regulations for Field Artillery, 1911.

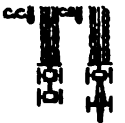
The maneuver of all special classes of artillery is assimilated, in so far as practicable, to that of light artillery. The following remarks, therefore, follow the regulations for light artillery, already quoted, and apply to other classes with the necessary modifications.



Section Column



Flank Column



Double Section

Formation of a Section

FIGURE 10.

The basis of all drill movements is the section. This, it will be remembered, may consist of a gun and caisson or of two caissons. It has three formations:—section column, flank column and double section. (See Fig. 10.)

Formations of section

In section column one carriage follows the other at two yards distance. In flank column the two carriages are abreast, with seventeen yards interval (length of a horsed gun carriage plus two yards.) In double section the two carriages are abreast, with two yards interval. This last formation is peculiar in that it is maneuvered as a single carriage. Thus, if a section is in either of the other two formations, and the command "left about" is given, each carriage executes the movement separately, and the relative order of the two is reversed; but in double section the pivot carriage executes the movement as if alone, the other conforming to it, and the relative position is preserved.

Double section is not only a convenient march and maneuver formation, permitting the shortening of the column by a half when its front, six yards, is not too great, but it is also a means of transition from march to fighting formation. It has been explained in a previous chapter that in the firing position the gun and caisson are abreast, one foot apart, caisson on the left. It is evident, then, that much movement of the carriages by hand is avoided by forming double section before unlimbering.

In limbering and unlimbering, the gunner is in charge at the piece, aided by No. 1; No. 4 is in charge at the caisson, aided by No. 5; Nos. 2 and 3 assist by manning the wheels of either carriage as required. When much movement by hand is necessary, all the men work together, and move the carriages successively.

Unlimbering

The carriages may be unlimbered to fire in any direction by the commands, "Action front (rear, right or left)."

If it is intended to fire to the front, double section is formed with the caisson on the left. Upon unlimbering, the caisson body is already faced in the proper direction; it is established on the desired line, and determines the position for the gun. This is turned about so that the muzzle points to the front, and placed beside the caisson. Unless a trench is dug to hold the trail spade, the gun is run a foot or so ahead of its true position, to allow for the recoil which takes place at the first shot, when the trail spade has not yet buried itself.

To fire to the rear, the carriages are placed in double section with the caisson on the right. When the piece is unlimbered, its trail is lowered directly to the ground; the caisson is turned about and placed in the position thus determined for it, beside the gun.

To fire to a flank, double section is formed with the caisson on either side of the piece. After unlimbering, the carriage on the side toward which fire is to be delivered is first established in position, and all the cannoneers assist in bringing the other up to its place.

In all these movements, it will be seen, the carriage which requires the less man-handling is established to mark the position, and the other then placed beside it, in such a manner that, when the movement is completed, gun muzzle and caisson trail are pointing in the same direction, and the caisson is on the left. To avoid confusion in tracing out these maneuvers, it must not be forgotten that the front of a carriage limbered is the direction in which the horses are facing; of a gun unlimbered, the direction of the muzzle; of a caisson unlimbered, the direction of the trail.

The limbers, in service, are placed under cover somewhere in the neighborhood, preferably on a flank, out of the line of shots directed at the guns; at ceremonies, they are twenty-five yards in rear of the line, facing to the front.

Preparation for action

Before firing, and either before or after unlimbering, the carriages must be "prepared for action." By this is meant, that the elevating and traversing gear is unlocked and inspected; sights and quadrant placed in position; shields unfolded and secured; breech and muzzle covers removed; and breech mechanism examined. Before limbering "march order" is resumed.

Limbering

The easiest way to limber is "front and rear." In doing this, the limbers approach their carriages and separate, caisson limber passing across the front and piece limber across the rear of the position. When the limber axle is opposite the piece or caisson trail, the limber is halted and swung ninety degrees on its own ground, so that caisson horses are facing to the front and piece horses to the rear, and then backed slightly. This places them both conveniently for limbering, without moving either carriage by hand.

Often, however, this simple method is impracticable, as, for instance, if the firing position is just in rear of the crest of a hill, so that the caisson horses would be exposed if they moved out in front of their carriage. The section may then limber "rear." The caisson is brought about, trail to the rear; the piece is run to the rear ten yards. The limbers move up to the trails of their respective carriages as before, but both are then swung around so that the teams face to the rear. Running the piece to the rear gives the necessary room for the caisson team to maneuver in limbering.

Formations of battery

The formations of the battery are, essentially, only two—the sections abreast of each other, in line, or following each other in column. But several varieties of each are distinguished, since the sections themselves may be in any one of the formations above described.

The following descriptions of formations are quoted from the Drill Regulations:

"655. The habitual formations are the *order in line*, the *order in section column*, the *order in flank column*, and the *order in battery*.

"656. The order in line is that in which the sections of the battery are formed abreast of each other in the order, or the reverse order, of their numbers, from right to left. The carriages are limbered, and in each section are in section column, the pieces being either in front or in rear of their caissons. In the normal order in park the pieces are usually in front.

"If the carriages of each section are in double section, the formation is called a double section line.

"657. The order in section column is that in which the sections of the battery follow each other in the order, or the reverse order, of their numbers, from front to rear. The carriages are limbered, and in each section are in section column, the pieces being either in front or in rear of their caissons.

"If the carriages of each section are in double section the formation is called a double section column.

"658. The order in flank column is that in which the sections of the battery follow each other in the order, or the reverse order, of their numbers, from front to rear.

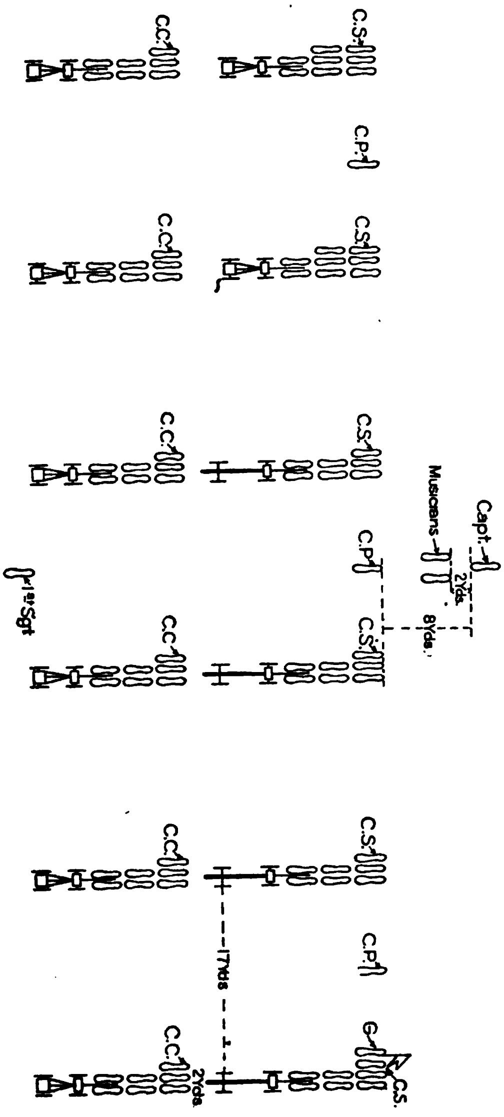


FIGURE 11. BATTERY IN LINE.

The carriages are limbered, and in each section are in flank column, the caissons being all either on the right or left of their pieces.

"649. On subdivision for action, the battery is divided into the firing battery, the combat train and the field train.

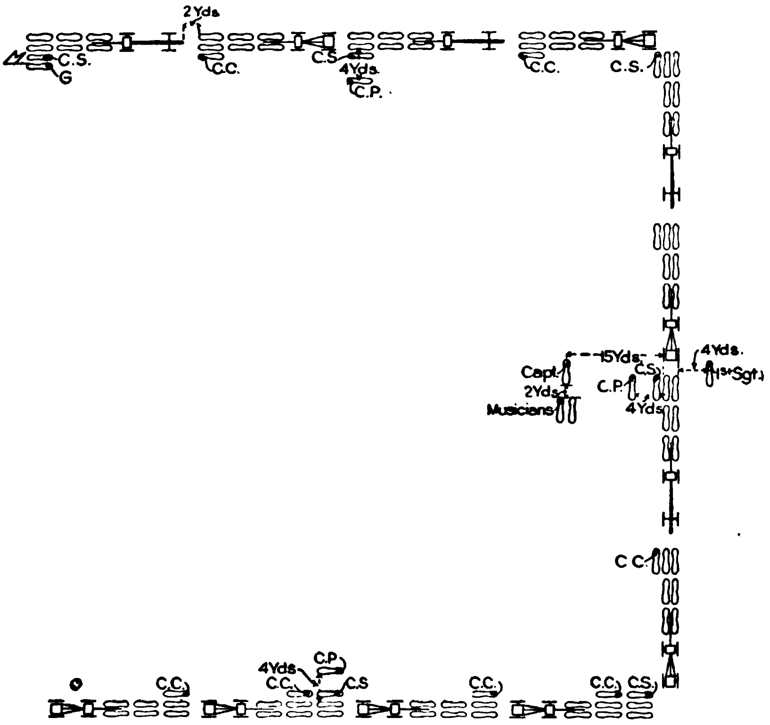


FIGURE 12. BATTERY IN SECTION COLUMN.

"The firing battery comprises the first five sections. It is under the immediate command of the captain.

"The combat train comprises the sixth, seventh and eighth sections; the battery wagon; the store wagon;

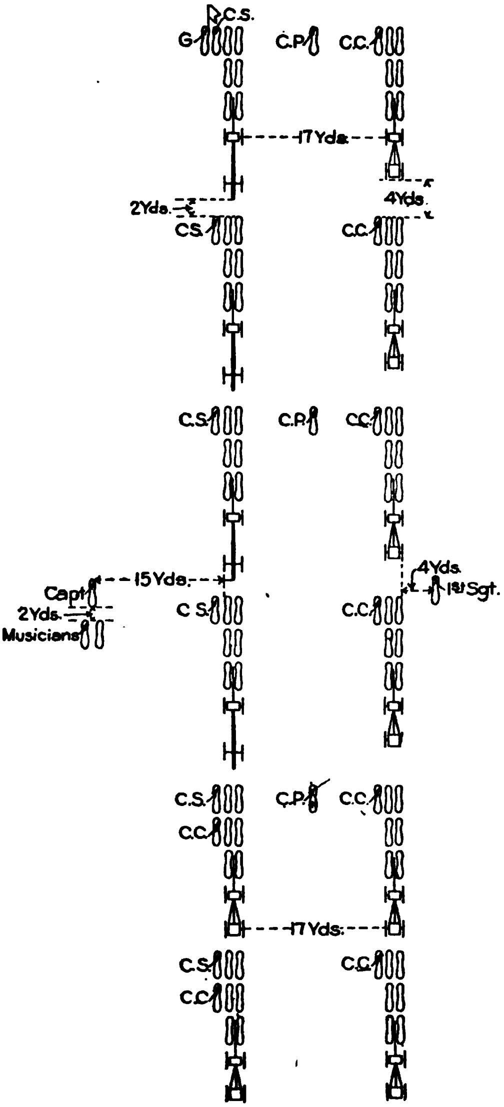


FIGURE 13. BATTERY IN FLANK COLUMN.

the reserve men and at least one pair of harnessed wheel horses and one pair of harnessed lead horses. It is commanded by the junior lieutenant, who is assisted by the stable sergeant.

"The field train comprises the allotted field wagons and such personnel as may be directed to accompany them. It is commanded by the quartermaster sergeant.

"659. The order in battery is that in which the pieces and caissons of the gun sections, unlimbered for action, are placed in line in the order, or the reverse order, of their numbers, from right to left; the caissons of the fifth section, unlimbered, one on each flank of this line; and the limbers either in rear of their unlimbered carriages, or formed at such other place as the captain may direct.

"The reserve, consisting of such other caissons, etc., as may be present, is posted at the discretion of the captain."

Suitable means are provided for passing from one formation to another, but only those affecting preparation for action, formation in battery, and resumption of march formation, seem to require mention here.

Preparatory to going into action the command, "Form and prepare for action," is given. Each carriage of the firing battery is prepared for action, and the battery subdivided, as explained in Par. 649 of the Drill Regulations, quoted above; the reconnaissance and signal officer (chief of third platoon), and the combat and field train commanders report to the battery commander for orders.

If the command is simply "Form for action," the battery is subdivided, but the carriages remain in

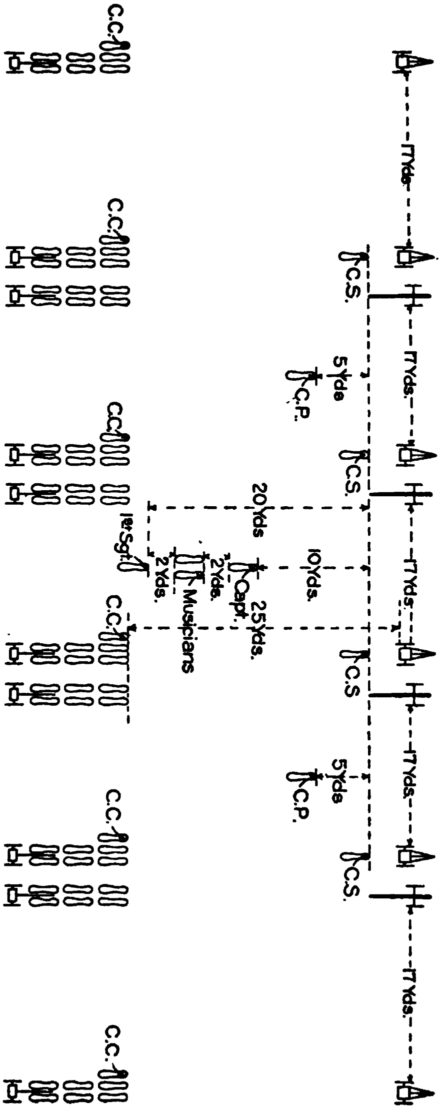


FIGURE 14. BATTERY IN BATTERY.

"march order." This formation is habitually used on the march, to get combat and field trains to the rear and allow the infantry to close up forward.

Formation for action

Before unlimbering, the firing battery forms double section line or column—the former to unlimber front or rear, the latter to unlimber to a flank. If the limbers are not to take their drill ground position, in rear of the carriages, the battery commander gives instructions to the first sergeant as to where they are to be posted; as soon as the carriages are unlimbered the limbers wheel to the rear, clear the line of guns, are formed in column by the first sergeant, and conducted by him to their posts. Drivers are then dismounted, and the senior caisson corporal placed in charge; the first sergeant returns to the firing battery. It is the duty of the non-commissioned officer in charge of the limbers to provide for communication with the battery commander, so that the limbers shall come up promptly at the command or signal for limbering.

All mounted men with the firing battery dismount; their horses are led off by the drivers, except those of the battery commander, first sergeant, musicians and orderlies, which are kept near the battery under cover.

In the absence of special instructions, the caissons of the fifth section separate at the command for unlimbering, and are placed on the flanks as already described. The section is reassembled by its chief, without orders, immediately after limbering.

The formations of the battalion and regiment are simply combinations of those of the battery. The

Formations of battalion and regiment

normal interval between batteries in line or in battery is twice that between sections of a battery; distance between batteries in column, one carriage length. In column of batteries, where each battery is in line, full distance is battery front; closed distance is carriage length. A battalion in column of batteries at closed distance is said to be in mass. Full interval in a line of battery columns is battery length; closed interval, carriage length. Between battalions all intervals and distances are double those between batteries.

Communication system

When we consider the battery as a mobile unit in the field, and the higher units as combinations of mobile batteries, we see at once that the officer commanding a unit can not always remain immediately with his command. The guns and the system of handling them are designed for fire from concealed positions; someone, properly the commanding officer, must be where he can observe this fire; and this often necessitates his being some distance from his command. Hence the artillery commander has a double need of a thoroughly worked out system of communications—his command itself covers a good deal of ground, and he frequently has to take his own station at a distance from it.

Equipment

Communication by word of mouth is the quickest and most reliable. Megaphones are carried, to permit use of this method whenever it is possible. For cases where it is not, each unit has its signalmen, permanently detailed and specially trained, and equipped for both visual signalling and telephone work. For the former, a very rapid semaphore code is employed. For the latter, batteries use buzzer wire and hand reels; higher units use heavier wire, and are provided with special four-horse carts (or, in mountain regiments, with pack-mules) to carry the wire reel and the signal and fire control instruments. The telephones are of a special type, very light and compact, and generally very satisfactory.

Signalmen

The battery signal detail consists of a corporal and two privates, who are assigned to the 5th Section; the corporal and one private are mounted, the other private rides on a caisson. Each battalion and regimental detail consists of one non-commissioned officer and one private, both mounted, besides drivers for the carts or pack-mules. Each battery has three telephones:—two for a battery line, to connect the battery commander with his guns, or with an auxiliary observing station if one is used, and one to connect with the battalion commander's line. A battalion has two:—one on the battalion line, connecting with the batteries, and one on the regimental line. A regiment also can operate two stations:—one on the regimental line, connecting with battalions, and one connecting with the brigade or other higher commander if a line is established. The badge of a signalman is a red and green band on the left sleeve.

An artillery brigade has no signal equipment and personnel of its own. If a brigade line is required, the brigade commander takes what he needs from some regiment or battalion of the brigade which happens not to require all its own equipment. Communication between an artillery brigadier and his division commander would normally be provided for by the Signal Corps.

Signal communication, however, is not sufficient to provide at all times for the necessary connection between artillery troops and commanders, and hence men are detailed from each unit as "agents of communication."

Agents

Further, it is constantly found necessary to send men out to a greater or less distance, to secure special information necessary to facilitate the movement or employment of artillery; hence scouts are detailed in each unit.

The men permanently assigned to these duties are selected for their aptitude, and given special training. The general training is naturally somewhat similar for both classes, and, as each may often be called upon to perform the duties of the other, or of the signal men, all are instructed in all three kinds of work.

The principle upon which agents of communication work is, that it is the business of every unit to provide for communication with the next higher commander. Each battery sends a corporal to report to the battalion commander; each battalion, a sergeant to the regimental commander; each regiment when in brigade, an officer to the brigade commander. The agent from the highest artillery command, whether this be a battery or a brigade, reports to the commanding officer of the whole force.

An agent is distinguished by a red band on the left arm. His general duties are to transmit orders and information from the higher commander to his unit; his most important special duty, to mark the route of the officer to whom he reports, when he goes forward on reconnaissance.

This latter duty is of the highest consequence.

When a force of artillery is to come into action, its commander generally precedes it, sometimes by a long distance, to reconnoiter the position. It is necessary, in order to avoid delays, that the batteries follow at once; but the commander can not, in general, give definite instructions as to the route to be followed. Hence he posts men at points where doubt might arise, to give direction as to which way to turn. Agents are used, if available, for this purpose. If they are not present in sufficient number, scouts, or other available mounted men, are used. A man so posted, after performing the duty assigned him, rejoins the commander by whom he was posted as rapidly as possible.

Besides the permanently detailed agents, special details are often necessary. For instance, when artillery is subdivided for action, it is the business of the combat and field train to keep in touch with the commander of their unit. This they do by means of agents, detailed for the purpose from their own strength.

Scouts

As scouts, two men are detailed in each battery, six at battalion headquarters, and four at regimental headquarters. Their distinguishing mark is a green arm band. Their duty, like that of any other scouts, is to secure information; but the information that they are trained to collect is such as has peculiar value to their own arm. Reconnoitering parties sent out by the commander of a mixed force will bring him the information that he himself requires; but in general, when he has formed his plan and assigned the different troops their parts in the execution of it, each unit will find that it needs special information, which it must get for itself. Artillery is even more dependent upon such special reconnaissance than the other arms; from tactical considerations, in that it acts at great distances and against partially or wholly concealed objectives; from technical considerations, since it requires some information of peculiar kinds, which would not be collected or even sought by a general reconnaissance.

Artillery scouts generally work in pairs; sometimes singly, and sometimes, on important missions at a distance, in parties under a reconnaissance officer.

Often they accompany the leading elements of the advance guard, or the advance cavalry; at other times they work independently. They are sent out to find and report on roads and artillery positions; to locate targets upon which the artillery is to fire, and report dispositions in the vicinity of the target, either of friendly or hostile troops; or to observe the effect of fire, when that can not be done by the commander himself. They are posted to give warning of the approach of hostile parties; in exceptional cases, when artillery is in an exposed position, with little or no protection from other arms, it may have to rely entirely upon them for such warning.

Fire direction

The system of communication just outlined enables the commander of any artillery force, large or small, to control the fire of all his guns quickly and certainly. Any intermediary between the commander and his command is a bad thing—there is no other way of giving orders that is as good as direct verbal communication—and hence the whole system of communications may be said to be most useful when not used at all; but it is a highly necessary evil. By using such parts of it as the circumstances of each particular case require, the battery commander manages his guns, whether he is with them or distant from them; this function, called "conduct of fire," is purely technical, and the objectives of fire are considered as targets and nothing more. But when we consider the battery, as we are now doing, not merely as a firing machine, but as a tool to be used for tactical purposes, the need arises for the exercise of a higher function—"fire direction," or the tactical application of fire. In the exercise of this function also, certain parts of the communication system are in general used.

Fire direction is normally a duty pertaining to battalion and higher commanders, but no sharp line can be drawn. The commander of a battery acting alone may have to direct as well as conduct his own fire. A battalion may be in such a situation that the battery commanders can not have their own targets and observe their own fire; in such case the major must conduct the fire of the battalion, handling it as one large battery. But such procedures are abnormal, and work unsatisfactorily. Conducting the fire of a battery is a "man's size job." The captain who tries to do it and follow the general tactical situation at the same time is overloaded, and does both things poorly. The major who tries to conduct the fire of three batteries at once will probably get but little more effect out of the twelve guns than out of four.

The officer directing the fire of several batteries receives the orders of his superior as to the tactical purpose that his command is to serve, together with such detailed instructions as the case requires in regard to positions, targets, etc. It is his business to translate these orders from the general tactical language into artillery dialect:—to select the particular targets that he must take under fire to accomplish the purpose, and decide when to fire upon each; to designate and apportion these targets to his subordinates, having due regard to any special conditions that may make a particular target easy for one and hard for another; to furnish his subordinates with any information useful to them in the attack of their targets, which may be available to him but not to them; to keep himself informed as to the effect of the fire, rectifying errors or misunderstandings; and to keep touch with the troops he is supporting and with the general tactical situation, and modify his own dispositions from time to time so as to play his proper part in the general scheme. The brigade commander thinks in terms of regiments, seldom less; the regimental commander habitually in terms of battalions, and the battalion commander in terms of batteries; but the battery commander thinks in terms of firing data.

CHAPTER VII.

ARTILLERY POSITIONS.

From one point of view, selection of position may be said to be of less importance to artillery than to other arms, for a battery or even a battalion can fire when only one man can see. But from another, it is much more important than to any other arm; artillery acts by fire only, and therefore must always fight in line and at a halt. Changes of position are for it critical maneuvers, causing delay if nothing worse.

Choice of position

In choice of position infantry or artillery may have the first consideration, according to circumstances. Usually the artillery has to conform to the infantry dispositions, but cases do arise where the artillery requires first consideration. The point has to be determined after consideration of the whole tactical situation; the commanding officer of the entire force must make up his mind what service he is going to expect from each arm, and assign general positions accordingly.

Duties of commanders

In a large force, the commanding general will probably only be able to tell his artillery commander what his plan is and what part the artillery is to play, receive his recommendations as to positions, and approve or modify. The artillery commander is entitled to this much—after that, he is responsible for details. If time permits he should report his dispositions, for incorporation of further details in orders to the whole command. This is desirable, but not absolutely essential if subordinate commanders all do their proper part in establishing tactical connection.

Passing down the chain of command, we naturally find that assignments to positions become more and more definite, until in the case of an individual battery the battalion commander's orders may leave the battery commander very little latitude. But at every step the obligation rests upon the superior to give the subordinate the best possible information on all points that may affect his action.

Requirements of position

"The only invariable rule in the choice of a position is to so post the guns as to be able to carry out effectively the task assigned them."* But some positions are good and others bad, and in making a choice numerous desiderata must be kept in mind.

Range

In the first place, the range must be suitable. With light guns, it is desirable to get within 3000 or 3500 yards at the outside; with heavy guns, these figures should be increased by 1000 yards or so, and with mountain guns decreased about the same amount. If the range is too long, the difficulty of observation is greatly increased, and the reduced area covered by the shrapnel cone increases the ammunition cost of getting any given result. When observation is good and the result is worth the ammunition expenditure, longer ranges are permissible; when there are good covered approaches, shorter ones are desirable.

A broad field of fire is evidently an advantage, since it enables one battery to act against many targets without moving, and perhaps do the work of several batteries. It will probably have to use long ranges against some of these targets, however.

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*Drill Regulations for Field Artillery, 1911, par. 813.

Field of fire

Concealment is always to be sought unless it interferes with effect. The degree of concealment depends upon the situation; if a battery is to deal with rapidly moving targets it will probably have to give up concealment almost entirely, so as to use direct laying, but if the ground and targets are favorable it may use high defilade.

Cover

A great many other points will readily suggest themselves to be considered in selecting a position. Thus, it is desirable that there be good facility for movement in any direction, under cover; that the teams be well protected; that the ground be firm, to resist the wear and tear of firing; that good aiming points be available, etc. The relative importance of these points depends upon the purpose in view, the nature and extent of the target, and the dispositions of friendly troops.

Minor points

When more than one battery is concerned, dead spaces may be avoided by skillful distribution of the batteries. This involves a physical dispersion of force, but, as we have already seen, the gaps, if not excessive, may be closed by proper use of the telephone and signal equipment, and the troops are not actually dispersed so long as their fire is under control and capable of concentration.

Distribution of forces

Concealment, as we have just noted, is an important element in an artillery position, provided always that it is not allowed to interfere with fire effect. Some degree of concealment is usually to be found. Even if direct laying is to be employed, the guns may ordinarily be placed with "sight defilade"—that is, behind some little cover in such a way that the gunners can just see the target through their sights. If the background is favorable, if bushes or high weeds are scattered about in front, and if the men are careful to keep down and avoid unnecessary motion, the battery may be kept entirely invisible.

Degrees of defilade

Indirect laying permits a good deal of freedom in the selection of position, and sometimes makes it possible to conceal even the gun flashes. The degree of concealment in any particular case is roughly described by saying that the guns have dismounted, mounted or flash defilade against a specified point.* These terms are self-explanatory; flash defilade, or the amount of cover necessary to conceal flashes, is generally taken to be about twelve feet. In all the present discussion it should be remembered that cover means concealment only. Protection is not involved, except in so far as concealment gives it; for if guns can fire out of a position, other guns can fire into it.

Kinds of positions—illustrations

Whatever the degree of cover available, expedients for making it hard for the enemy to adjust his fire should not be neglected. Imagine, for example, two parallel ridges, a few hundred yards apart. If direct fire were required, we might put our guns on the extreme front slope. This would give minimum dead angle and also

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*The words "against a specified point" should not be overlooked. The word "defilade" has no significance without mention of the point against which defilade is taken; nevertheless it is not uncommon to hear it used alone. See Field Artillery Journal,. December, 1911:—translation from Major Aubrat's "*Exercices de Service en Campagne dans le Groupe de Batteries.*"

minimum concealment; but even if the guns were actually visible to the enemy, a hedge or similar partial cover a few hundred yards to the front might interfere with accurate observation of fire by the enemy.

Again we might withdraw our guns behind the crest, taking sight defilade against the target and maintaining the direct laying. This would be a good direct fire position if there were no immediate probability of having to fire at very close range, but there would be danger of getting the guns against the sky line, and the crest itself, if well marked, would be a guide to the enemy in adjusting his fire.

The next step would be to withdraw the guns a little more behind the first crest, and use indirect laying. Here the first thing would be to make sure that the lines of fire clear the crest at the shortest probable range. Subject to this limitation, we might take any desired degree of defilade, remembering, however, that if we mean to observe fire from the crest itself, taking high defilade will leave the battery commander a long way from his guns, and may narrow the field of fire out of regard for the safety of the observing party. If it is probable that it will be necessary to run the guns to the crest for direct fire at close range, taking high defilade has the further bad effect of requiring more movement by hand. As to the enemy's adjustment of fire, the same remark applies as in the preceding case; if the battery is located as being somewhere behind the crest, the enemy can adjust on the crest itself, and "search" behind it, raising his range progressively. How far behind the crest he would carry this search would depend upon the amount of damage the battery was doing his troops, and the amount of ammunition he could afford to expend; the chances are that he would not try to cover more than 300 or 400 yards, for firing blindly involves a great expenditure of ammunition.

There would be two more ways of occupying our assumed position. The guns might be placed on the second ridge, either in front of the crest, screened by the forward ridge, or behind it. Whether this is better or worse than the preceding plan depends largely upon which crest is the more conspicuous from the enemy's standpoint, and hence the more likely to draw his fire. Which of the two emplacements on the second ridge is preferable depends chiefly upon the conformation of the ground and the facilities for movement of carriages and teams. The position on the forward slope of a second ridge, which is slightly higher than the first one, offers unusually good facilities for observation, and if the two ridges are more than 400 yards apart affords the guns a good deal of security. Col. Reichmann, in his report of observations in Manchuria, gives the following example of a position of this type:

"At Liao Yang two batteries of the First Siberian Corps stood on perfectly open ground in front of Shushan Hill, and small shelters had been dug for the men; 700 yards in front was a low round hill entrenched for infantry, which hid the batteries from view. Immediately in rear of the batteries rose Shushan Hill, and some distance up the slope was a Russian artillery colonel with an observing party, who regulated the fire of the batteries below by means of a megaphone. Though standing perfectly in the open, these two batteries did not suffer much, simply because the enemy's guns did not find them, in spite of a furious bombardment."

Observation stations

The difficulties of observation from a concealed position are often considerable. In Chapter III mention has been made of masts and ladders designed to raise the observer off the ground and give him a better view without going too far from the guns. Sometimes, especially with heavy guns or howitzers, it is desirable to occupy positions where even such devices as these do not give the necessary view. Firing in such cases has hitherto been very slow and laborious, if not entirely impracticable; very distant observation stations have been employed, involving many complications, or captive balloons, with their obvious disadvantages. Recently, however, good success has been obtained with observation from aeroplanes, and it is probable that this procedure will soon be sufficiently developed to play an important part in the fire of heavy guns, if not of light.

Aeroplane observation

The aeroplane for this purpose should be a two-man machine, so that the operator can give all his attention to the flying and the observer to the firing. The method of observation will vary with circumstances; a system that has given good results in experiments is for the aeroplane to make a preliminary reconnaissance while the battery is coming into position, and return to the battery a map with the position of the target noted upon it. The battery is laid upon the target by the map, and prepared to fire. The aeroplane then starts in rear and flies toward the target, passing nearly over the battery. As it passes, the battery fires two salvos in rapid succession, changing the range by say 400 yards. The observer is provided with weighted cards, on which are eight little crosses, so disposed as to represent, roughly to scale, the eight bursts of the two salvos. As the projectiles burst, the observer notes on a card the position of the target with respect to the two salvos. Returning, he drops the card near the battery, the laying is corrected and the process repeated.*

In addition to the classification of positions according to amount of cover, there is a further classification according to the purpose for which they are occupied.

Definition of special terms

If the situation is clear, batteries may be placed in position *for immediate action*, that is, for the purpose of opening fire at once. If the time for opening fire has not yet arrived, but is thought to be near at hand, and the approximate direction of the target can be forseen, the batteries may be placed *in observation;* that is, they may be unlimbered and prepared for action, and firing data determined for prominent points in the field of fire. Trial shots may be fired for partial verification of the data. This process of preparation is called *registration of fire*.

If the direction of fire cannot be forseen, positions may not be occupied, but merely selected. Preparations are then made to fire from any one of several positions, but the guns held limbered at some convenient place until further developments. They are then said to be *in readiness*.

These terms are very convenient, but should be used with care. Particularly, they should never be used in orders without sufficient explanatory remark to make the task of the artillery clear—and when these remarks are added it will often be found that the terms themselves are no longer necessary. In short, these expressions are excellent when employed for the purpose—and with the effect—of expressing thought; they are both annoying and dangerous when used to conceal a lack of it.

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*Revue Militaire Suisse, January, 1912; Militär Wochenblatt, January 13, 1912. From newspaper dispatches it would appear that aeroplanes are being extensively used for this purpose in the present European war; details of the methods employed are not available.

Whenever occasion arises for the use of artillery, as thorough reconnaissance as time will permit should be made, with a view to finding the best position available, and finding it without wasting time in changes from an inferior one. If it is necessary to get into action quickly for the support of other troops, no time can be spent in searching for technical advantages; but generally the necessity for employing the artillery can be forseen, and opportunity gained for preparation.

Reconnaissance of position

The artillery reconnaissance is necessarily based upon the information and plans of the officer commanding the whole force. He can greatly assist his artillery commander, and hence himself, by keeping him fully oriented as to the situation. With this general knowledge, the artillery begins its special reconnaissance.

To insure an early start in this reconnaissance, it is sometimes well to attach artillery officers and scouts to the advanced troops, and also to have the reconnaissance officers of subordinate artillery units join the artillery commander when action is imminent. The general principle of the reconnaissance is for each commander to go out ahead of his command, receive the orders of his immediate superior, and in turn give his own orders to his immediate subordinates as they arrive.

Brigade

Thus, in an infantry division, the artillery brigadier, whose proper place is with the division commander, receives his information as to the general situation and the general plan, and his orders as to the part that the artillery is to play. He then looks over the ground, assigns his regiments their duties and the areas within which they may work, and arranges for communications both within his own command and with other troops. As early as possible he sends for his regimental commanders, and gives them their information and orders.

Regiment

Regimental commanders proceed to their areas, sending for the battalion commanders to join them there. Within their own territory they perform the same functions as the brigade commander, except that, the areas and forces involved being smaller and their problems definite and limited, their reconnaissance and assignment of positions may be more detailed and precise. Battalion commanders in their turn send for battery commanders and proceed in the same way; they assign batteries definitely to positions, give sufficient instructions as to such details as observation stations, communications, and posting of limbers, to insure that the batteries will not interfere with each other, see that the security of the position is provided for by neighboring troops or by scouts, post the combat trains if they are marching united, etc. At each step the necessary messages for subordinate commanders to report are habitually sent through the agents of communication, who, as we have seen in Chapter VI, regularly remain at each headquarters for this purpose.

Battalion

Each battery commander examines his target and the ground assigned him, and selects and marks the precise spot for his guns. He assures himself that each gunner can see the target or aiming point, and that the guns can clear their masks; selects his observing station and arranges for any necessary communications; decides upon the best route of approach; selects a place for his limbers, and for his combat train if it is with the battery; secures his firing data; and places the battery in position.

Battery

In reconnaissance and occupation of position, each commander is assisted by a reconnaissance officer and by the special details of scouts, agents and signalmen mentioned in Chapter VI. In commands higher than the battery, the adjutant acts as reconnaissance officer, and has the sergeant major as principal assistant. The battery reconnaissance officer is the chief of the third platoon, whose command is broken up on forming for action, one section going to the firing battery and the other to the combat train. His principal assistant is the chief of the fifth section.

Reconnaissance parties

Any artillery commander, when going forward on reconnaissance, habitually takes with him all or a part of his special details. Agents or scouts are posted to mark his route, and the batteries follow unless ordered to wait. Positions having been selected, they are usually occupied by the batteries independently; occasionally a higher commander may bring in all his batteries together, but this is likely to be cumbersome.

The battery commander, having received his orders, goes to his assigned position, marking the route if necessary. Having decided upon the details of occupation, as above described, he generally posts a scout to mark the position of the directing gun, indicating to him the direction of fire, the direction of the line of guns, and the aiming point. He sends his reconnaissance officer to establish an observation station, giving him this same information, and also instructions as to the communications to be established, both with the guns and with battalion headquarters. Under the direction of the reconnaissance officer, firing data are prepared for the targets or reference points indicated by the battery commander; communications are opened; the targets or suspected areas are taken under observation, and if desired panoramic sketches are made. (Fig. 15.) These sketches show in barest outline a perspective of the country within the assigned area, with such targets as may be discovered; the positions of these targets are shown by noting opposite each its

Preparation of position

Panoramic sketches

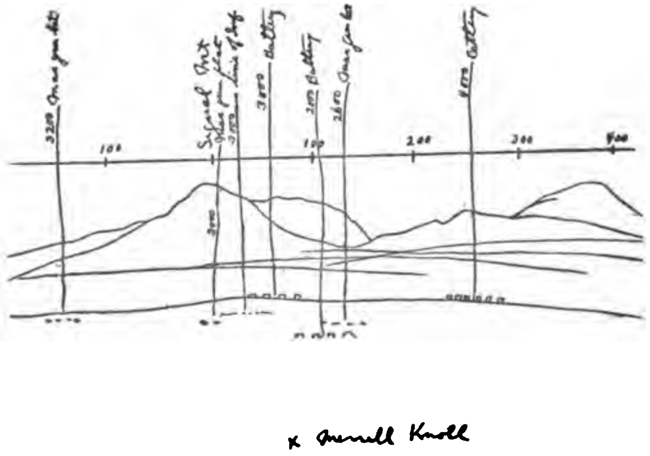

FIGURE 15.

estimated range from the sketcher's position, and its angular distance in mils from a selected reference point. As Col. Bethell picturesquely puts it,* "rabbits in the foreground" are not wanted; military, not artistic, effect is to be sought. They are very useful at the firing point, in opening fire quickly upon any desired target or shifting it from one to another, but not of general utility, like a regular position sketch, for they are misleading and confusing unless used at or very near the point where they were made.

With well instructed men, the battery commander need give only general supervision to all this special work. He is, or should be, free to observe his targets, or to ride back, meet his battery, and lead it into position. As a rule it is not necessary for him to rejoin the battery; if he does not, the senior lieutenant puts it into position. The usual procedure is for this officer (called the executive officer) to bring the battery on until near the position, and then ride well ahead to see how it is marked out and to receive any special instructions the battery commander may have to give. At his approach, the scout marking the position faces the target, extends one arm toward it, and the other along the intended line of guns. If an aiming point has been indicated to him, he communicates it to the executive officer. The battery ordinarily approaches a covered position in double section column from a flank, so as to avoid risk of showing the teams over the mask, and unlimbers "action right (or left)". The executive officer points out the aiming point to the gunners. The first sergeant posts the limbers as directed, places them under charge of the senior caisson corporal,

Occupation of position

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*Modern Artillery in the Field, p. 242.

and rejoins the battery to regulate resupply of ammunition and replacement of casualties.

The limbers are placed under the best cover available, in rear and to a flank of the guns if possible, where shots directed at the battery will not reach them. They should preferably be within 300 or 400 yards of the guns, so that they can reach them quickly when wanted. The combat train, if with the battery, is similarly posted, 600 or 800 yards in rear; if the battery combat trains have been consolidated by battalion or regiment, they are so located as to permit easy access to all batteries.

A position once occupied should not be changed unless a very distinct advantage is to be gained by so doing. The guns are useless and vulnerable while in motion, and time is lost in ranging again in each new position. Simply getting in to closer range is usually not a sufficient reason for moving, if the guns are doing effective work where they are. But changes of position may become necessary as an action develops, and should be anticipated and prepared for.

Change of position

The new position is reconnoitered in the same manner as the old one. The commanding officer of each unit decides, according to the circumstances, whether he should make the reconnaissance in person, or send his reconnaissance officer with all or a part of the scouts, etc., while he himself remains to supervise the fire or movement of the guns. In any case, particular attention should be paid to selection of the route to be followed. If the batteries have already fired, and attracted the attention of the enemy, cover is more essential than before.

If the batteries are actually in action and under hostile fire, it may be impossible to bring up the limbers without such loss of animals as would practically immobilize them. It will then be necessary to wait for a lull in the action, or perhaps for darkness. In the latter case, care in marking the route is very essential.

A considerable force of artillery usually changes position by echelon, part of the batteries firing while the rest move. A single battery generally makes no such attempt, for, as we have seen, the battery is primarily a technical and not a tactical unit, and is never divided when it can be avoided. If, however, an exposed area is to be crossed, it may move by single carriages so as not to offer so conspicuous a target.

There is no fixed rule as to formations and gaits in changing position. Generally, however, it is regarded as a good plan to commence the movement at a walk, to minimize excitement in the batteries themselves and among neighboring troops.

An important change of position should be made only upon the orders of the commander of the whole force. In emergencies, the artillery commander on the spot should order the necessary changes, reporting them promptly to his immediate superior and to any neighboring troops affected. Since the artillery may be posted at a considerable distance from the commander and the troops with which it is acting, it is desirable that each artillery commander, according to his grade, be informed of what he needs to know of the general plan, so as to make such changes as he is forced to undertake conform to it.

"When an important change of position is imminent, battery commanders must endeavor to have the ammunition chests of the firing battery fully replenished in readiness for the movement.

"A battery which has expended all its ammunition does not for that reason retire; it secures a fresh supply. While awaiting replenishment it shelters the unemployed personnel.

"A disabled gun is not sent to the rear during the action; if it can not be repaired on the firing line it is left there.

"As a rule, batteries are not relieved, but are supported by fresh batteries.

"Batteries will not retire, even in the face of imminent danger, without orders. The loss of well-served guns in the defense of a position, or in close support of the other arms is honorable."*

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*Drill Regulations for Field Artillery, 1911, par. 861.

CHAPTER VIII.

ARTILLERY TACTICS.

It is very common and very natural to attempt to divide the subject of tactics into many little sections, and to try to treat separately the tactics of each individual arm or even subdivision of an arm. Thus we hear not only of infantry, cavalry, artillery tactics, but of the tactics of machine guns, of heavy artillery, of sanitary troops—and tomorrow we shall probably have the tactics of aeroplanes. As a matter of fact, there is only one subject of tactics; all the numerous subdivisions are not separate subjects, but merely the same thing looked at from various points of view.

Definition of subject

So, then, we may take it at the outset that the expression "artillery tactics" means simply tactics looked at from the artillery standpoint. Tactics ought to be simply tactics, without any qualifying adjective. The terms "infantry tactics," "artillery tactics," may be looked upon as admissions of imperfection, or at least of incompleteness. The ideal is a system of tactics of the combined arms, in which each plays its part accurately; there should be no more thought of "independence" by infantry, cavalry or artillery than by the strings, brass and wood-wind of an orchestra, or the cylinder, piston and connecting-rod of an engine.

Failure of coördination is due to the imperfection of the instrument employed, taking the instrument to mean both machine and operator. Any improvement in the machine will soon bring about the necessary technical skill of the operator, and we may then look for better coördination with other machines of the system.

This is what is now happening as a result of the improvements in artillery matériel. The personnel itself is gradually winning to a mastery of its weapons; the next step is adjustment to the needs of the infantry; then comes a corresponding modification of infantry methods to facilitate this adjustment; and the result is one more step from infantry and artillery tactics toward the tactics of the combined arms.

This readjustment of the reciprocal relations of the two arms is well reviewed in the following extract from an article published in the Italian *Rivista de Artigleria e Genio* for September, 1911:

> "The adoption of the rapid fire field gun, besides causing considerable changes in the tactical handling of artillery, has had its effect also upon the use of the other arms, especially the infantry. This will be clearly seen from a comparison of the old and new tactical ideas.
>
> "With the old guns, the artillery was expected first of all to engage the enemy's artillery with all possible force. The reason for this was found in the construction of the guns, which, not having any convenient means for indirect fire, generally had to expose themselves. Hence it was possible, by a superiority of fire, to cripple the enemy's artillery; and since this superiority of fire could be gained only by using a superior number of guns, every available battery was put into action as early as possible.
>
> "The artillery duel, once begun, generally continued until one or the other party was annihilated, for the reason that, the batteries being unshielded, their only means of defense was to continue the fire. Therefore, when one side ceased firing, it could be assumed with

little risk of error that it was out of action, at least for a considerable time.

"Hence the principle of massing guns for concentrated effect, with the definite intention of engaging the enemy's artillery, which was applied with such success by the Prussians in 1870–71, and which was accepted without question almost to the present day.

"During the artillery duel, the infantry advanced and engaged the hostile infantry. This action usually continued until the artillery of one side or the other, having disposed of its own adversary, came to the assistance of its sister arm with all its remaining force, concentrating its effort at that point where the resistance was weakest.

"The battle of Wörth may be taken as a typical example of this procedure. The Prussian artillery, massed on the plateau of Dieffenbach, engaged the French artillery, while the Prussian infantry, crossing the Sauer, became involved in an obstinate contest with the French infantry for the possession of Fröschwiller. No decisive success was obtained until the Prussian artillery, having silenced the French guns, was able to take a more direct part in the infantry action.

"The battle thus consisted of two separate engagements, fought with the same object in view, and coming into close connection at the end, but developed independently of each other. Thus, in the course of time, an exaggerated importance came to be attributed to the artillery duel, so that ultimately the action of the one arm was subordinated to that of the other, and it was held that the advance of the infantry could not begin until the artillery duel was decided.

"The adoption of the new armament caused radical changes in these theories. The characteristics of the new matériel which most strongly influenced military students were the improved protection of personnel and matériel, and the great increase in rapidity of fire.

"The increased protection, due only not to the shields but also to the new methods of laying, which facilitated the use of covered positions, has greatly reduced the effectiveness, and hence the importance, of the artillery duel. The enemy's guns can no longer be permanently silenced by artillery fire alone. Even if definitely located in its covered position, artillery can always shelter its personnel behind the shields while volleys are being directed upon it, ceasing fire for the moment but resuming it at the first opportunity. Being unable to get immediately decisive results in the old way, the artillery has had to find new ones. Its first and principal objective can no longer be taken, *a priori*, to be the hostile guns, but from first to last it must fire upon whatever target it can attack most effectively. What that target is at any particular moment must be determined by the progress of the infantry action, and by the information received from it.

"Extremely rapid fire being possible, effort should be made to utilize this power to the full, taking care, however, not to waste ammunition. Hence the fire, as a rule, can not be continuous, but must be in short violent spurts, coming irregularly and unexpectedly. Hence, silent guns are not necessarily silenced guns; their silence is the calm before the storm; their volleys are thunderbolts.

"All this demonstrates the necessity of active and constant observation of the battlefield, and also of proportioning the number of batteries sent into action to the importance of the immediate target, instead of throwing them all in at once.

"The infantry, for its part, has recognized that the artillery alone can no longer silence the enemy's guns, and needs the help of its sister arm. The infantry can no longer wait for the artillery to prepare the way for its advance; it must move on, cautiously and slowly of course, but promptly; thus it can force the enemy to reveal his position, and expose himself to the combined fire of infantry and artillery. The work of the infantry is consequently harder than ever. It must be better prepared than ever, both morally and technically, to face the destructive and nerve-racking fire of artillery; it will be the principal target, and will have no notice of the presence of artillery except the bursting of the shrapnel.

"But this is only one side of the question. As the infantry advances, there will come a time when it has to face the effective fire of both infantry and artillery; and then it will need the help of its own artillery if it is to get on. It is now necessary for the artillery to regulate its action according to the needs of the infantry, drawing upon itself the fire of the enemy, or beating down that part of the hostile force which is doing the most damage to the infantry.

"Infantry and artillery fire should supplement each other; the two arms must constantly work together, seeking to gain superiority of fire as the *sine qua non* of success. Instead of acting along parallel lines the two must now act together. Tactically each arm supplements the other, so that the action of each is the condition precedent for that of the other; hence a system of constant communication between them is absolutely necessary."

The purpose of an army is to win battles. In the process, the infantry plays the predominant part; each of the other arms owes it certain assistance, and, conversely, has the right to expect certain assistance from it. Let us see how, in a general way, this works out practically as affects the artillery.

Method of treatment

A great battle will necessarily be made up of countless minor episodes, partial engagements; first one side will be successful, then the other. But in general we may say that all these minor affairs merely lead up to, accompany, or follow, some one critical phase, which consists of a decisive attack by one party upon some position, more or less prepared, held by the other. Hence we can get a pretty good idea how things should or must be done, if we follow the course of one such attack and defense.

We may imagine a force on the defensive, and another attacking it. For our purpose it is immaterial how or why the defensive attitude was assumed—whether voluntarily and deliberately, or hurriedly and under constraint. But the force is there, and has made such preparation for defense as time and circumstances permit. A particular position, we will say, has been entrusted to a division, the smallest unit made up of all three arms.

The general defensive line being determined, the question is how to occupy it. Since infantry can not act at such great distances as artillery, it usually receives the first consideration, and the artillery is made to conform to its needs. In special cases, however, the condition is reversed; for instance, on a given front, there may be only one suitable position accessible to the artillery, and the infantry, being able to move and fight on more difficult ground, is required to give way.

Organization of defense

The position probably falls, more or less naturally, into several sections. Each of these receives certain troops, whose commander is given such degree of independence as the case requires. To some of these commands artillery will be permanently assigned; but care will be taken not to detach more batteries than necessary from the main artillery command. If they remain under the control of their own commander, they are available for use anywhere; if they are assigned to some one else, it may be harder to get them back promptly when no longer required.

This preliminary distribution leaves the division commander considerable forces, both of infantry and artillery, at his own disposition. Some small parts of these may very likely be used in front of the line, in connection with cavalry, to develop the enemy's force and line of advance, and to delay him. But the bulk of them are held back, to be thrown into the main fight whenever and wherever they are needed. The artillery, as well as the infantry, may in some sense be said to constitute a reserve; but there is a radical difference in the methods of handling them. The infantry is intended to be held as long as possible, and sent in only as the final argument; the artillery is intended to be used as soon as possible, and is held back at the start only because, in the nature of things, the defender has to play to the attacker's lead. The reason for this difference is, that when the infantry is once sent into action it is almost impossible to change its objective, or use it for any other than the original purpose; artillery, with its present long range and indirect firing methods, can often be kept in action indefinitely, changing target at will over a wide front.

Some of the guns assigned to the subordinate commanders may very likely be put in permanently, in entrenchments, at selected points of the defensive line. But a mobile gun is worth much more than an immobile one, so the larger part of them will be placed "in observation"*; that is, they will be unlimbered in a covered position and given a particular area to watch. Complete firing data will be prepared for conspicuous landmarks, and each battery will hold itself in readiness to fire at a moment's notice upon any target appearing within its area.

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*See Chapter VII.

Part of the guns remaining in the hands of the highest artillery commander will also go into observation positions; the rest will be held "in readiness"*, limbered, to be sent into action as soon as the direction of the attack can be determined. For these batteries, several positions will be reconnoitered and prepared, so that they can occupy any one without delay or confusion.

On the part of the attacker, there will necessarily be a gradual and tentative advance. His advance guard, which in a large force will of course contain artillery, will at first suffice to push back any small detachments that it may encounter. As he comes nearer, he may find detachments that seem strong in artillery; he can not tell at once whether these intend real resistance or mere delay, so he may be compelled to slow down, and bring up help from the main body. But after a time it will become apparent that he is opposed to the enemy's whole force, and he will have to prepare for a general engagement.

Dispositions for attack

In making dispositions for the attack, the same principles hold—that batteries should be detached from the artillery command, and assigned to local forces, only if the desired result cannot be obtained otherwise. But since the attacker makes his own law, instead of taking it from the enemy, he can arrange for more intimate connection between the two arms than the defender.

The defense is not likely to be drawn into an artillery duel of the old classic type. In all probability it will hold its artillery fire as long as possible, to keep the attack in doubt as to the position. But the advance of the attacking infantry will draw fire, and the artillery of the attack must be ready to help.

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*See Chapter VII.

During the preliminary stage, the dispositions may somewhat resemble those of the defense. A few guns will be put into action, but a large force will be kept in observation or in readiness, so as to take no chances of even a temporary inferiority. An artillery duel will result, but as an incident to the advance of the infantry, not as a decisive phase of the battle.

As the information of the commanding general becomes more complete, his plan of attack will form itself. His separate columns will begin to move out against their individual objectives. In some cases batteries will be definitely assigned to these columns; in others, they will remain under the orders of the higher artillery commanders, and be assigned simply to support particular columns. Their general positions and objectives will be given them, and they will be ordered to fire upon such particular targets as may be designated by the commander of the column. This evidently necessitates a system of direct communication between the attacking infantry and the supporting artillery, which will be more fully discussed in the next chapter.

In the course of the attack, the batteries will naturally fall into groups. Part of them will be assigned to keep down the fire of the opposing guns; and to do this each battery will be assigned its own part of the enemy's front to watch. The rest will directly support the infantry, firing upon the trenches at the point of attack until the infantry has come to close quarters, and then, when the fire endangers their own friends, lengthening the range and firing upon the ground over which the enemy's supporting troops must come up. These batteries may have to change position several times, and some of them will keep as close to the infantry as possible, so as to be able, in case of success, to help hold the captured position; but changes of position are always bad, and when a battery has once gotten its fire adjusted it should stay in place as long as it can do its work.

Let us now examine this general sketch a little more closely, and follow out to a more definite conclusion some of the lines of thought suggested.

Responsibility of commander

First, we see that artillery can not be set off to one side, given vague orders, and allowed to shift for itself. We must start with a definite conception by the commanding general of his own task and of his solution. He must decide upon certain specific things to be done, and assign some subordinate to do each of them, giving each such troops as he thinks necessary; that is, he organizes temporary battle units. If one of these units is to perform its functions with some degree of independence and at some distance from the rest, any artillery required must be detached from the main artillery command and placed definitely under the orders of the unit commander. If another unit's function is less independent, it may be that the necessary artillery support may be given by guns of the main command. All concerned must be distinctly informed of the make-up of the temporary unit, and to what extent the artillery in each case is under the orders of the unit commander. And in all cases it is the business of both subordinates—the commanders of the temporary unit and of the artillery assigned to it or ordered to support it—to establish communication at once and maintain it throughout.

And now comes the temptation, to which we so often see commanders in maneuvers yield—to assign all the guns to the different subordinate groups and wash their hands of them; to let the artillery commander go, or send him, away from headquarters to join some group of his batteries. The commanding general thus ceases to have any considerable influence over his artillery, or over the fight as affected by it; and the artillery commander either disappears from the scene, or he interferes with the proper work of some of his subordinates, and very likely gets the guns into a separate fight of their own, having but little relation to the infantry action.

But if the general uses his chief of artillery skillfully, the duties of the latter, far from ceasing when the batteries have been distributed according to the general's first instructions, are only just beginning.* His place is still at the headquarters of his general; it now devolves upon him to keep in touch with events, and modify the initial distribution of batteries accordingly. Has an independent unit, for which artillery has been detached from the main command, completed its task? It is his business to apply for the return of the detached batteries. Does it appear that some partial attack, supported by guns of the main command, is having an unexpectedly easy time? He should at once withdraw part of the batteries. In this way, he should always seek to have batteries in hand for a new demand, building up a force upon which he may draw.

Reserve of artillery

It is not essential that these batteries be withdrawn to a position in rear, like an infantry reserve. An infantry unit in action does not become available for other use by the simple command "cease firing," but with artillery the process may sometimes have almost this simplicity. A battery in a masked position, even if it has been in action and has attracted the enemy's attention, may often be given new tasks and new targets without difficulty, changing position unseen or perhaps taking up the new work in the old position. But it is the business of the chief of artillery to know what batteries are available, and to what extent they are free.

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*Percin, "The Artillery at the Picardy Maneuvers," English General Staff translation, p. 146-7.

Another matter in which the general may get good service out of his chief of artillery is in selecting the particular classes of guns to be assigned to the various tasks. Each class has its own particular uses, and it is no more a matter of indifference whether heavy rifles or light howitzers are assigned to a particular task, than whether it is to be considered a cavalry or an infantry job.

Use of special types

The light gun is, as Col. Bethell says,* the "maid of all work" of the artillery. It is designed for the average case, and consequently may be used fairly well in any case if no qualified specialist is at hand. It has good mobility, good power, good range, good ammunition supply, good rate of fire—a very well balanced general utility weapon.

The horse artillery gun sacrifices something of its power, range, ammunition supply—any or all of them, to get greater mobility. Nevertheless it is in the light gun class, and is to be selected when slightly increased mobility is of more importance than slightly decreased power.

The light howitzer has a heavier projectile than the corresponding gun, a reduced velocity, and consequently a higher trajectory. Its ammunition supply is much less, and its fire slower. At short ranges it can be used as a heavy field gun, but it is most valuable where the nature

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***Bethell, "Modern Artillery in the Field," p. 286.**

of the position or the location of the target calls for high angles of departure or fall. It can fire from close behind a railway embankment or a steep hill; it can reach hostile infantry in trenches or hostile artillerymen behind their gun shields, and can fire over the heads of friendly infantry when the two skirmish lines are in close contact.

Mountain guns are very weak as compared with the other types, they have not the capacity for rapid movement, and their ammunition supply is very limited. On the credit side of the account we may set their ability to go anywhere:—for we may almost say that where a man can go the mule will follow him and bring the gun; and even where the mule can no longer go, the gun is light enough to be carried a short distance by hand. It has the further advantage of being small and inconspicuous, either in action or on the march, and thus is excellently adapted for close support of infantry.

Heavy guns or howitzers have high power and long range. Their principal disadvantages are great weight and limited ammunition supply. The difficulties due to weight of guns—slowness and difficulty of movement —may be minimized by forethought and good reconnaissance; when the guns are once in position the long range compensates for lack of mobility by making changes of position unnecessary. Heavy guns near the center of a long line can, provided observation is good, distribute their fire over the whole front, or two units at opposite ends may concentrate their fire in the center. In attack, heavy artillery may support both frontal and flank attacks from the same position; in defense, it may be able to turn its fire from an attack already wavering to a new force coming up from another direction.

The difficulties arising from the great weight and consequent scant supply of ammunition are more serious. Assuming that say two heavy or five light batteries can fire equal weights of ammunition in a given time, the difference in effect will be that the light batteries will make more hits and the heavy batteries get greater penetration.* Hence if the target is narrow and heavily fortified we shall get greater results out of our given weight of ammunition by using the two heavy batteries; if it is broad and lightly fortified, the five light batteries will do better. No heavy gun should be used when a light one is available and will do the work satisfactorily, on account of ammunition supply. This applies especially to howitzers, whose ammunition is even heavier and more limited in quantity than that of the guns, and which are especially adapted to destroy material obstacles and to search behind cover.

A recent occurence in the Balkans gives us a good illustration of an effective combination of several types of gun. The description is based only upon a newspaper account,† but if it is not accurate it deserves to be. At Monastir, in November, 1912, the Turks held a position on the hills east of the town, prepared to meet threatened attacks by the Greeks from the south and the Servians from the north. On the north line they had a battery of 3″ guns. The Servians, arriving first, placed a 4.7″ battery in position at 9000 m., and 3″ guns at shorter range. The heavy battery opened fire, and silenced the Turkish battery. The Servian 3″ guns fired upon the Turkish infantry, and prepared the way for an infantry attack, which was accompanied by a mountain battery. The Turks brought up two more 3" batteries, and opened fire upon the flank of the advancing infantry; the heavy battery turned its fire upon these at 10,000 m., and put them out of action. The Servian infantry then carried the position.

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*Balck, "Taktik," II, 199; Krueger's translation, 232.

†"L'Illustration," Paris.

The power of heavy matériel makes it possible to use batteries separately more freely than with light guns, especially in defense, where each battery can have its orders beforehand and make thorough preparations to cover its ground. But the same principle applies to heavy as to light artillery—the tactical unit, the battalion, should be held together as long as possible to facilitate communication and fire direction. There are not many of the big guns, and their ammunition supply is scanty, and so the fire should be carefully directed by tactical superiors, and every round should be used at the right time and on the right target.

As a general rule, of course, the heavy guns take as their targets objects that are beyond the range or power of the light. Thus, they might be able to reach a river crossing or the mouth of a defile, when a covering force held the attack too far away to use light guns; or they might attack shielded guns which the light artillery failed to destroy. The heavy rifle is especially fitted for such use; but if opposing light batteries can get in close enough they can silence the heavy ones, by reason of their rapid fire and larger ammunition supply.

According to a seemingly reliable newspaper report,* a striking instance of this victory of light guns over heavy occured in Macedonia in July, 1913. A Greek division was checked by the fire of a Bulgarian 120mm. battery, which was in a partially concealed position

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*"L'Illustration," Paris, August, 1913.

8000 m. ahead, completely commanding the direct road by which the division was marching. A Greek 75mm. battery, leaving cover suddenly, advanced on the road at a gallop; although in view from the Bulgarian position, its speed was so great that the heavy guns failed to get in any effective shots—in fact, the move was so sudden that the battery had covered 800 m. before the first shot was directed at it. Having advanced thus nearly half way to the Bulgarian position, the light battery reached a new line of cover, took a masked position, and soon silenced the partially exposed Bulgarian guns.

Battle units

To the matter of temporary battle units a great deal of attention has been given recently in France, and the bitterest of paper warfare has been waged over the assignment of artillery to them. One view is that of Gen. Percin, perhaps the most prominent of their present day artillerymen*—that while artillery should not be detached thoughtlessly, still when an assignment is made the fullest of control should be given to the unit commander over all his troops, artillery included. Another is that expressed by Col. Thionville,† that the artillery should ordinarily remain under the direct command of its own chief, and be split up and assigned to subordinate units only in exceptional cases. Both views claim official support; the partisans of the former point to a War Department circular and those of the latter to the Drill Regulations.‡

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*Percin, "The Artillery at the Picardy Maneuvers," English General Staff translation, p. 144. Percin, "Cinq Années d'Inspection," p. 584 ff.

†"Le Commandement et la Liaison," Journal des Sciences Militaires, October 1, 1911.

‡Circulaire ministérielle, March 10, 1910. Règlement provisoire de manoeuvre de l'artillerie de campagne, September 8, 1910.

The fact that two official documents of nearly the same date could take such divergent views indicates the confused state of professional opinion on the subject, but it would seen that the two views are not really so irreconcilable after all. Each party admits that the procedure advocated by the other is correct "exceptionally"; perhaps in the last analysis the disagreements would not be so numerous.

General Percin's fear is that if the batteries are not placed under the actual command of the officer executing a particular task, but merely ordered to support him, there may be a failure of coördination; the danger exists, and the only way to avoid it lies in a clear understanding by the artilleryman of what is required of him, and strenuous efforts on both sides to establish and maintain tactical connection. His opponents fear that if the artillery is split up and assigned to temporary units, it will be impossible to utilize to the full the power of the fractions; this danger also exists, and can be avoided only by a spirit of mutual helpfulness on the part of the unit commanders, and by watchfulness and activity on the part of the chief of artillery.

The decision must lie in the hands of the general. If he thinks that his subordinate can carry out his task only by having full control of all his troops, he should give him his artillery unconditionally, and take the chance of not being able to get hold of it again promptly. If, on the other hand, he feels that two or more subordinate tasks are so closely related that all the units can best be supported by one central artillery force, he should retain such a mass; it is then the duty of the officer commanding it to make and modify his assignments of particular batteries to support particular movements, and see to it that proper tactical connection is maintained.

Tactical connection

After the preliminaries are out of the way, and the opposing forces have learned enough about each other to make definite dispositions, the immediate control of the artillery devolves upon the subordinate officers. In each particular battle unit, the senior artillery officer (regimental or battalion commander) places himself in communication with the unit commander, learns his plans, and disposes his batteries to assist them. His problem, it will be noted, is not to decide how many and what batteries can be sent to accomplish a given purpose; it is one of execution—he must work out the best way to accomplish the given purpose with the alloted force.

Suppose, for example, that in the course of the preliminary fighting, a particular infantry brigade has been pushed up toward a particular front held by the enemy. Certain artillery also has been brought up to the same vicinity, and parts of it have been in action. A fair idea has been gained of the general outline of the enemy's infantry position, and some of his artillery has been located. The brigade is ordered to attack, and a battalion of artillery is ordered to support it.

The battalion is brought up while the infantry is making its dispositions to advance, and takes position in observation. The battalion commander may perhaps assign each battery its own sector of observation, or simply designate reference points, for use in assigning targets later. The batteries may be close together or separated, according to the circumstances of the particular case.

The brigade begins its advance, and meets opposition—say rifle fire from trenches. The battery most favorably placed is directed to open fire upon this target. Hostile artillery now opens fire upon the first battery, and the second replies; the enemy's guns being concealed, it fails to destroy them, but its fire is effective enough to make theirs slow and ineffective. The third battery is available to reply to new hostile guns, or to assist either of the others.

The general idea is that there should be enough guns ready at the outset to give reasonable assurance that they can carry through the fight; but on the principle of "economy of forces" only as many should be used as are necessary at the moment. If possible, whenever a battery opens fire, another should be at hand to protect it.* There may be a temptation to rush them into action as fast as they come up, as the Confederates did at Malvern Hill, but it is not good tactics. In that particular case, the trouble was partly due to the difficulty of finding and reaching positions, and partly to defective organization, which interfered with proper control; but the result was that the compact masses of Federal artillery had no difficulty in dealing separately with the small forces successively sent against them.

If the artillery support is not sufficient, it is necessary to have recourse to the chief of artillery, and draw upon such available guns as he may have. If the general is really trying to force an entrance into the hostile position at this point, the guns will doubtless be forthcoming, otherwise not. The reinforcing batteries may be sent over with orders to report to the brigade commander, or the chief of artillery may direct them merely to communicate with the commander of the artillery battalion already in action, and take some of his targets.

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*Drill Regulations for Field Artillery, 1911, par. 867.

Changes of position

If the infantry makes good progress, it may become necessary for some of the batteries to move forward to closer range, in order to accomplish their tasks. Several reasons may compel this. For one thing, the proper protection of the flanks may very likely prove impossible except from close range; if, for example, the enemy should be able to place a few flanking guns behind some obstacle, in such a manner that they could not be reached by frontal fire, they could cause great loss and confusion in the attacking force if no artillery were present to reply to them.

Another reason is the desirability of affording moral support to the infantry during the advance, through the presence of its "indispensable companion." The French especially attach great importance to this feature, and regard it as essential "that the infantry should feel the constant and immediate support of the accompanying batteries, and that these should reach the conquered position at the same time as the infantry."

It is said that the shields now attached to the guns render it possible to serve them under fire from closer ranges than formerly, in spite of the increased power of that fire; and that consequently the batteries should not hesitate to go in, more particularly as they, together with the infantry, will be under the powerful protection of the guns which remain behind, firing over their heads.

All this is quite true, as far as it goes, but it does not touch the real objection to this procedure of sending in the guns. The professed object is moral support; but if the guns make long stops to fire, and in so doing utilize the protection of their shields, they will soon lose touch with the infantry. If, on the other hand, they make several changes of position, advancing step by step with the infantry, they will, at each halt, waste at least a short time in ranging; moreover, during these movements, they will lose so many horses that they will soon be permanently stopped. In either case the moral support vanishes.

There is something in the idea of moral support, but it ought not to be emphasized too much. Batteries must be sent in to close range, for this and other reasons, but it should be done with judgment, and after due consideration whether the conditions require it—not as a matter of course. The guns can not remain immediately with the infantry in any case, if they are to do any firing; and it would seem that their fire ought to have much the same moral effect upon their own infantry, whether delivered from a position 500 or 2000 yards in rear of it. And if it is a mere question of fire effect upon troops in position, a range of 3000 yards is as good as 1000, provided the observation of fire is satisfactory; sometimes better, in fact, for the greater angle of fall of the projectiles enables them to search cover better.

Such an advance at this stage can not be made off-hand. It having been decided that it is to be made, the ground over which it is to pass will have to be thoroughly, although rapidly, studied, positions and the routes to them selected, and every possible means taken for security. The number of batteries to be sent should also be considered, in view of the terrain and the object of the movement.

In executing the advance, batteries should move successively, so as not to cause a complete cessation of fire at any time. Each part of the force should advance under the protection of the fire of some other part.

A most striking warning against a faulty execution of this advance is found in the battle of Colenso. Gen. Hildyard's brigade, which advanced directly upon the town, was supported by two field batteries and six naval guns. As the infantry advanced, Col. Long, commanding the artillery, ordered his whole force forward. The field batteries, more mobile than the naval guns, got far ahead of their own infantry, came into action within 800 yards of the Tugela River, and found themselves under a terrible fire, not only from infantry and artillery on the hills beyond the river, but also from infantry on the hither bank. Nearly all the horses were killed; the guns were fought in splendid style until most of the men were gone, when they were abandoned, and the remaining men sought shelter in a small ravine 150 yards to the rear. An attempt by the infantry to save the guns failed, and all but two were left behind when the British withdrew. These two were saved only by the most extraordinary exertions and at enormous cost.

This incident has been dwelt upon at some length on account of the many lessons it teaches. First, the artillery preparation was insufficient, the guns moving up before the infantry was within striking distance. Next, the naval guns did not cover the advance of the field batteries, but all were in motion at the same time. Finally, the reconnaissance had been incomplete, and when the batteries approached the river they were surprised by fire in their front and right flank, from riflemen whose presence on the hither side of the river had not been known.

The system of apportioning batteries just described is the basis of the modern French system of artillery tactics, which is accepted, in principle at least, by the majority of our officers. In connection with it there has grown up a convenient system of nomenclature.* The same caution is required in the use of this nomenclature as in that descriptive of the various classes of positions (see Chapter VII)—there is a temptation to use the descriptive terms in place of precise instructions, to avoid the necessity of accurate thinking.

Definition of terms

The principal division is into *infantry batteries* or *breaching batteries*, and *counter batteries*. The former directly prepare and support the infantry attack, firing upon the trenches at the point of assault; the latter are the ones told off to protect them by firing upon the enemy's guns. There are a number of other similar terms, which are usually self-explanatory—batteries of counter-attack, accompanying batteries, reinforcing batteries, decoy batteries (guns partially exposed to draw the enemy's fire), etc.

A battery's particular designation may change from time to time—it will act now as a counter-battery, now as an infantry battery. Its methods of fire also will vary with the circumstances, probably alternating violent bursts of rapid volleys with slow continuous fire, or at times ceasing its fire altogether. If conditions are favorable, the effort will be to destroy the target, and remove it permanently from the enemy's strength. If it proves that this is impossible, it will probably be equally good for the immediate purpose to neutralize it—that is, hold it stationary and inactive.

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*Drill Regulations for Field Artillery, 1911, par. 802.

Methods of fire

Suppose that a battery is ordered to fire upon a body of infantry seen in the open. To take advantage of the favorable target, it fires rapidly, by volleys. The infantry reaches a patch of woods, and disappears; the battery ceases firing and watches for its reappearance. The infantry seeks to advance from the woods; volley fire is opened again. Or suppose the infantry entrenched; knowing that shrapnel fire will do little material damage, the battery commander nevertheless tries to keep the enemy from moving or firing. The fire will be slow and continuous so long as he lies quiet, becoming more rapid if he tries to do anything. Col. Bethell assumes a trench 100 yards long, and a battery firing ten shots a minute at it, and discusses the subject thus:*

"Taking the effective spread of the shrapnel bullets at 20 yards, each rifleman will be liable to be shot twice a minute if he puts up his head to fire. After each shrapnel bursts over him, he will have only thirty seconds to make up his mind, to get up, pick up his target and fire. If the rate of artillery fire were absolutely regular, the rifleman would soon get accustomed to firing between shrapnel bursts. But if, while maintaining the average steady rate, the rate per minute and the distribution be judiciously varied, the rifleman will never know when a shell is coming, and will be nervous about getting up to fire."

If the target is artillery, probably the first firing will be with volleys of time shrapnel, to try to make the men hug the shields and slow up the fire. If the guns were visible, the next step would be to get accurate adjustment with shell, and disable them. If they were concealed, the same method of neutralization would have to be adopted as described above.

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*Bethell, "Modern Artillery in the Field," p. 283.

One should be a trifle cautious about assuming that guns are out of action because they cease firing. Even with short range muzzle loaders, the defense could sometimes break off the artillery duel prematurely, to induce the enemy to make a premature assault. So on the last day of Gettysburg, Gen. Hunt found that he was having difficulty with his ammunition supply, and that he was getting no advantage over the Confederate artillery, which, in its extended position, could put more guns in action than he could in his cramped one. He therefore ceased firing, withdrew part of his guns, replaced crippled batteries by fresh ones which had not hitherto been able to find room to come into action, and waited. The Confederates, misled as to the amount of fight left in the Federal artillery, launched Pickett's division to the assault. The Federal batteries at once opened fire with undiminished vigor upon his infantry, ignoring the Confederate batteries; the latter, meanwhile, had themselves run short of ammunition, and were unable to support Pickett with their full force. An error of this kind would be much more easily made in the present days of long ranges and concealed positions.

Firing over infantry

Firing over friendly infantry will ordinarily be a necessity, especially in the final stages of an attack. The batteries designated for direct support of the infantry keep up their fire until the latest possible moment before contact; they then slightly increase their elevation and lengthen their fuzes, and sweep the ground just in rear of the enemy's firing line, preventing reinforcement or withdrawal of it.

Just when the fire should be thus diverted from the firing line is a delicate question. As fuzes, laying apparatus and observing intruments are improved, this moment may be postponed; but even so, the answer is no mere matter of calculating the danger space and ceasing the fire when the troops reach the near edge of it. The moral effect upon the infantry has to be considered; troops can not be expected to advance with confidence very close to the real danger line. On the other hand, if the fire ceases too soon, the defenders will be able to redouble the intensity of their fire. Many infantry officers say that they prefer to take some chances of getting a few shells among them from the rear, rather than dispense prematurely with the support of the artillery.

It is found from experiment and calculation, that on level ground at 3000 yards range a well adjusted shrapnel fire with our service 3″ gun may be kept up without serious danger of actual hits until the infantry is within about 150 yards of the target. The question has been raised, how near the men shells could pass without doing actual physical harm, and to decide this some elaborate experiments were made this spring at the Russian artillery school of fire.* Firing was conducted over still water, fine sand, frames covered with thin paper, and cages containing small animals. There was no noticeable effect unless the projectiles passed within a few inches, and none upon the animals even then; and it was concluded that a margin of two feet was absolutely safe. It thus appeared that infantry was physically safe, standing 400 meters in front of guns firing at 800 meters range, and that firing could be continued during an advance until the infantry came within 160 meters of the enemy.

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*Mitteilungen über Gegenstände des Artillerie- und Geniewesens, No. 4, 1914, p. 419.

But as remarked above, absolute physical danger is not the question; moral effect is decisive. It seems to be generally admitted that fire must cease when the infantry comes within 300 yards. Of course, if the approach to the position is up a slope, this distance may be reduced; and howitzers, owing to their steep angle of fall, may continue to fire almost up to the moment of the last rush. This, it will be noted, is one of the most valuable uses of howitzers, and they should always be represented among the batteries assigned to this duty.

Artillery supports

It was formerly common to assign special infantry supports to artillery, for its local protection. This is not now considered necessary unless the batteries are exceptionally exposed; support of artillery devolves upon the nearest troops, who should render it without specific orders. If a position does not seem adequately protected, the artillery commander posts scouts to give him warning of danger; but he ought not ordinarily to be placed in a situation requiring this. Barring surprise, artillery need not fear any frontal attack. It is vulnerable in the flanks only.

Malvern Hill may serve to illustrate this. The Confederates could not reach the Federal guns. Magruder's division made three desperate attempts, but failed. General D. H. Hill says that half the Confederate casualties were from artillery fire.

The flank of a line of guns is of course weak; but even here, if the force is small and the artillery has a little warning, the attack may be beaten off. Thus at Bull Run, General Hunt, then a captain, was in command of his own battery, "M," Second Artillery, and of Battery "G," Third Artillery, six guns in all. A force of Confederates appeared on his left, his batteries being at the moment not engaged in front. He, and the infantry near him, changed front to meet the attack; after fifteen minutes of rapid canister fire from the batteries, the enemy broke, the Federal infantry not having had to fire a shot. Hunt says in his report that he directed the men to omit sponging the guns (all muzzle-loaders, of course,) and take the chance of premature discharge, "for minutes were now of more value than arms." Fortunately, he was able to add that no accidents occured from this cause.

The general idea of the disposition of guns on the defensive has been indicated above. Batteries that may be assigned to small covering detachments may of course have full liberty in maneuvering and firing, for they seek only to delay and mislead the enemy. But batteries in the main position should not open fire without orders from the commander of the force. Firing at extreme ranges and upon small hostile detachments is to be avoided, for this assists the enemy in locating the guns.* The temptation is, of course, to fire too soon. Even as good artillery as the Austrians had at Königgrätz could not resist it, and fired as soon as the heads of the Prussian columns came in sight; if they had waited until larger forces were displayed, the effect of their fire would have been much greater.

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*Drill Regulations for Field Artillery, 1911, par. 874.

Choice of targets

During the course of the attack, the guns must be handled as required by the action of the enemy, firing upon whatever troops, whether infantry or artillery, may be doing the most damage. If the attack continues to make headway, however, and comes to an actual assault, the guns of the defense should devote their attention primarily to the infantry, disregarding the artillery as much as possible.* The old covered emplacements will probably not command the ground over which the attack is made, and the guns will have to move up and use direct fire.

If the attack is repulsed, the defender will usually try to take the offensive in his turn. If it is successful, part of the artillery must prevent the advance of hostile batteries into the captured position, while part directly assists the infantry in an offensive return.† The enemy will probably press his infantry strongly into the breach, and if, at the proper moment, a rapid artillery fire at short range be poured into the flank of this mass of troops, the effect will be destructive in the extreme.

This is what happened at the end of the second battle of Manassas. The right of the Confederate line was held by Longstreet, the left by Jackson. The Federal attack, made by Porter's corps, was directed upon Jackson, who was gradually pushed back. Porter's left flank was thus exposed to Longstreet; the enfilade fire of twenty guns broke up the attack, and enabled the whole Confederate line to move forward.

When the enemy's success bids fair to be more than a local one, the commander-in-chief will try to withdraw some of his guns in time to establish a rallying point in rear. Such as are not ordered back cover the withdrawal, and continue to make an unshaken stand. A withdrawal will be a difficult matter after the infantry assault is well advanced, and can be successfully made only if the ground is favorable. As for the guns that remain behind, it may be possible to save them, or a part of them, if a temporary success can be gained; if they are lost, the loss under such circumstances is to the credit of the personnel.*

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*Drill Regulations for Field Artillery, 1911, par. 875.

†Drill Regulations for Field Artillery, 1911, par. 876.

Withdrawal

The battle of Kōniggrātz is a conspicuous example of this wise prodigality of artillery. The Austrian batteries lost their guns, but saved the army. One of the most famous incidents of the battle occured when the Prussian infantry, having occupied Chlum, began to advance beyond it. Captain von Groeben brought his battery, the Seventh of the Eighth Regiment, into action within 200 paces of the edge of the village, to enable the other troops to draw off. The object was accomplished; but the battery lost its captain, one lieutenant, fifty-two enlisted men and seven out of its eight guns; the attack upon it came so quickly that it succeeded in firing only ten rounds.

On the second day of the battle of Gettysburg, when it was desired to withdraw four Federal batteries posted south of the Peach Orchard, one of them, Captain Bigelow's Ninth Massachusetts, was ordered to cover the movement of the others. This it did, firing canister until the enemy came literally up to the muzzles of the guns. The battery's loss was three officers, twenty-eight men, sixty-five horses and four of its six guns.

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*Drill Regulations for Field Artillery, 1911, par. 876.

A few words concerning artillery on the march may well be added here. Two considerations govern the position of artillery in an advancing column in the presence of the enemy—it must be near enough the head to be quickly available when needed, but not near enough to risk being caught in column of route by hostile artillery fire. These requirements evidently need careful balancing. The infantry must provide the artillery with a sufficient maneuvering zone to avoid undue risk, and a part of the guns should march as near the head of the column as is consistent with this requirement. A comparison of the Prussian orders of march in 1866 and 1870 is interesting in this connection. It will be found that in 1866 the guns were kept too far back, and came into action late; in 1870 they marched well forward, and every effort was made to get them into action early and in coherent masses.

Marching

A long column of guns would be very vulnerable in flank, and besides, if too much artillery is pushed forward, we may easily find that we have more guns than can be used at once, while the infantry is unduly delayed. For both reasons, the artillery column is broken by bodies of infantry. The guns that are thus left in rear should be able to get up by the time they are wanted, maneuvering at the trot.*

Heavy batteries, when a general action is not anticipated, ought generally to march well to the rear. They are slow in movement, occupy a long space on the road, and are likely to delay troops behind them by breaking light bridges and cutting up soft roads and fords. When not in the presence of the enemy, they may at times even be marched at the head of the trains.

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*Balck, "Taktik," II, 258; Krueger's translation, 300. Buat, "L'Artillerie de Campagne," p. 258.

When their use is anticipated, they should be brought forward in plenty of time, to avoid the necessity of moving them up by a long hard march. They may march with or even ahead of the light artillery of the main body, where they can be brought into action early, to cover the deployment of the light artillery and the infantry.*

This all applies, of course, to large units of artillery marching with the main body. In a force of some size, however, part of the artillery may and generally should be moved up into the reserve of the advance guard. Whether artillery should be thus used, and if so how much, is a matter for the judgment of the general; he knows what he wants to accomplish and must be the judge of the necessary tools. Usually, however, unless the advance guard needs a battalion it needs nothing. If the advance guard is so small that a battalion would overload it, and reduce it to a mere artillery escort, the chances are that no fight is expected, or else that the whole force is so small that artillery can get forward in plenty of time from the main body when needed.

Covering detachments

The action of advance guard artillery varies with the object in view. It should not occupy positions from which it can not be withdrawn without a general engagement, perhaps not intended by the commander of the force. Its main duties are to break down any resistance to the advance of the other arms, or to cover their retirement if necessary. Positions with as much cover as possible should be chosen, to preserve freedom of maneuver; the guns should be placed at large intervals, and fire rapidly, so as to deceive the enemy if possible as to the force opposed to him.*

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*Balck, "Taktik," II, 261; Krueger's translation, 304.

It is hardly an artillery question; but advance guards and other small detachments are sometimes tempted to use their guns to gain some little temporary advantage, which results in a positive disadvantage to the main force. For instance, when McClellan, after the Seven Day's Battles, was taking position at Harrison's Landing, Stuart's artillery commander found a position from which he could reach part of the Federal camps there. Stuart occupied it with one gun and a small force of cavalry, and opened fire without waiting for other troops to come up. The result was that a whole Federal division occupied the position, which had been very lightly held until then. If Stuart's one gun had not given the alarm, the Confederate infantry could undoubtedly have secured it, and seriously embarrassed McClellan.

If there is a probability of a general action following the engagement of the advance guard, the advance guard artillery should take care so to select its positions as to facilitate the deployment of the guns of the main body.

In a retrograde movement, the artillery of the rear guard has a difficult task, in that it must remain in position long enough to let the main body get on, but not long enough to become seriously entangled itself. In general, the rear guard will be stronger in artillery than an advance guard of the same size; and the guns can act only by retiring in echelon from one position to another. Occasionally they might get an opportunity for a brilliant success by waiting in a concealed position well out on a flank; but such an undertaking is risky, and could not often be attempted.

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*Drill Regulations for Field Artillery, 1911, par. 862.

The guns of the main body are widely separated from those of the rear guard, pushing on for positions in rear. If the commander still hopes to make a stand, he must get his guns in position somewhere as soon as possible, and rally his infantry under their protection; if he is not in a position to risk a fight, he has nothing for them to do, and will get them out of the way as fast as possible, clearing the roads for the rest of his force.

Artillery generally marches formed for action, its combat trains consolidated by battalion or regiment and held farther to the rear, perhaps at the tail of the infantry. The combat trains of the advance guard artillery may remain with the others, or be brought up to the tail of the advance guard. Wherever the combat trains march, they remain under the orders of their battalion or regimental commander unless detached by specific instructions; they remain always in touch with him through agents of communication, and receive his orders as to their disposition when the batteries go into position.*

Horse artillery with cavalry

Horse artillery with cavalry† should march united, well to the front; ordinarily none should be assigned to the advance guard. In a mounted action, rapidity is the essential, for the artillery as well as the cavalry. Open positions and direct laying are the rule; fire should be directed primarily upon the enemy's cavalry, only the minimum of attention being given to his artillery. In dismounted action, the general rules for light artillery with infantry apply, except that the fronts covered will generally be greater and the development of the action more rapid.

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*Drill Regulations for Field Artillery, 1911, par. 831.

†Balck, "Taktik," II, 405; Krueger's translation 471. Drill Regulations for Field Artillery, 1911, par. 878 ff.

CHAPTER IX.

TACTICAL CONNECTION. COMBINED MANEUVERS.

It was said in the preceding chapter that there is only one subject of tactics—that all artificial subdivisions of it are really different aspects of the same thing. Hence, after reviewing, as we have done, the methods of handling artillery, we feel that something is lacking, that the details are not yet sufficiently connected up with the subject of tactics.

Tactical connection

The matter of tactical connection with infantry has been hinted at from time to time in the previous chapters, but the subject is so vital that it deserves more attention than it has received. However energetic and correct the technical service of the guns, however skillful the fire direction, however appropriate the assignment of artillery to battle units, the work may be all wasted if proper tactical connection of the arms is not maintained.

This is not an artillery question, any more than it is an infantry question. It is purely and simply a matter of combined tactics. If it has special pertinence in a discussion of artillery, it is only because artillery always and necessarily works in double harness, and can never, like the other arms, operate alone. Hence things of this kind impress themselves more quickly and vividly upon an artilleryman.

It may seem at first sight that the connection is close enough if the commanding general marks out clearly the tasks to be performed by each body of troops, infantry or artillery—that he himself should give to each such information and such instructions as are necessary to enable them to act in harmony.

"Liaison par le haut"

This action on his part is certainly essential; it is what is known to the French as *liaison par le haut*, or connection through higher commanders. But to rely entirely upon this imposes too much of a burden upon headquarters; they become a circumlocution office, not only receiving information to be used by the general himself, but also data of no immediate importance to him, merely for transmission to someone else. Everything is alowed up.

This connection, important as it is, needs to be supplemented by *liaison par le bas*, or direct communication between subordinates. This idea was highly shocking when first proposed, for it seemed to many officers to be an abdication of the proper prerogatives of the general, leading certainly to anarchy. But it should cause no apprehension. As we saw in the preceding chapter, the general himself, or his chief of artillery acting in his name, decides what infantry and what artillery go to make up each particular battle unit, and the precise limits of the control its commander is to have over each element; he holds a certain check upon the subordinate's action in that he can, within limits, modify the constitution of the unit as he sees fit. All this being so, the business can be handled much more smoothly and effectively by direct communication than by indirection.

"Liaison par le bas"

The only real danger is that the system may be abused —that the impatient subordinate may acquire undue independence or the hesitating superior try to divest himself of part of his responsibility. Both things may happen, for here, as in other tactical matters, precise rules are out of the question, but the general principle is clear:—so long as the problem of the chief is one of organization, direct communication is the right and duty of the subordinates; when it becomes one of execution, the process of splitting up should cease.

Connection through the higher commander needs no comment. It is the familiar communication through military channels, as conducted at all times. Direct connection requires some consideration.

Forms of tactical connecion

We have seen that particular tasks on the battlefield are executed by temporary battle units. In each unit, the commander of the infantry is given control, complete or qualified, of the the artillery. At most, he may have entire command of it; at least, he has authority to point out its targets. Whatever the situation may be in this respect, it is the duty of both commanders to establish communication. In the past, with short range weapons, this was comparatively simple; the artillery could usually see what the infantry was doing, and act accordingly—*liaison par la vue* was sufficient. Something more is needed now, for the infantry is often out of sight of the artillery, or so far away that vision is not clear; actual exchange of messages, or *liaison matérielle*, is essential. The system will usually consist in an interchange of information officers or agents of communication, and especially in stationing a representative of the artillery at headquarters of the unit commander, and providing him with means of sending and receiving messages. A preliminary conference of the two commanders is also desirable.

It is objected that the establishment of this system will take too long. But if both infantryman and artilleryman think of it as soon as they get their orders, and try to organize it at once, it should be in operation by the time the infantry is fairly under way. If not, at least it will be working when the most important stage is reached—when the infantry is farthest from the artillery and nearest to the enemy.

Another objection is that messengers can not be sent to and from the firing line. The answer is that no such attempt will be made.* The commander of the battle unit is, say, a brigade or regimental commander; his position is not in the firing line, but well back of it. So long as he can remain in communication with his superior in rear, so long certainly he can remain in touch with his own artillery, also in rear.

Methods of connection

Besides, messengers are not the only means of communication. The officers concerned must use their ingenuity to provide other means. Telephones may sometimes be available, and if so the thing is simplified. Probably they will not be, and some kind of visual signals may have to be used. The use of signal flags near the firing line may seem as impracticable as the sending of messengers; but it is an unusual country that will not afford, somewhere near the infantry commander, a place concealed from the front and open to the rear, to hide a signalman. And the artillery semaphore code is very rapid and very legible; the artilleryman ahead has only to seek concealed stations for his signalman, and the one in rear has only to post a scout in a suitable place, with orders never to take his field glass off the flags.*

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*Percin, "Cinq Années d'Inspection," p. 208.

By previous arrangement between the two commanders, reference points should be selected, or other means provided for designating points briefly and certainly in messages. If difficulty arises, it may be possible to send back a rough sketch to guide the fire of the artillery; in this case, it should be remembered that the panoramic sketch is useless when the reader is not near the position of the sketcher, and an ordinary position sketch in bare outline, with directions and ranges, should be used instead.

Designation of targets

By proper use of such a system, the fire of the artillery can be directed with certainty, and not by guess, upon the target which is of most importance. If the infantry is stopped, the man on the spot knows whether it is the infantry straight ahead, the artillery straight beyond, or some other artillery on the flank, that stops it; the artilleryman in rear may guess, but he may guess wrong. A message from the infantry will set him right, and put him on the proper target. It will also enable him to fire at the proper time, so that the artillery preparation and the infantry attack may synchronize; at Liao Yang the Japanese bombarded the Shushanpu position for an hour with 200 guns, but the infantry assault was not made until after the fire had ceased, and was repulsed. And what is equally important, it will enable him to cease firing at the right time. In this same battle of Liao Yang, a Russian report says that the 34th Rifles at Sin-li-tun were driven from their position and the Japanese occupied it; the Japanese artillery knew nothing of this, continued their fire, and drove their own infantry out again.*

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*Ingenious devices for tactical connection are illustrated in the following dispatch. The kind of communication is not at all the same as that here under discussion, but the principle is the same.

"PARIS, Tuesday [Aug. 25, 1914.]—A dispatch received here from Bourges gives the recital of a French officer wounded in Lorraine. He tells how the Germans were aided by the local inhabitants, who had prepared for every eventuality.

"The officials of the villages in Lorraine fell upon the necks of the French troops when they came into town and greeted them as saviors. No sooner had they done this than they would go to the edge of the village and hang out French flags, big white sheets, etc., to indicate to the enemy the exact position of the French soldiers. The mayor of one village tapped a French telephone wire for the benefit of the enemy, after having offered a room in his house for the installation of the station. A local schoolmaster corrected the range of the German guns by moving the hands of the church clock."—*New York Herald*, August 26, 1914.

Gen. Langlois reached the heart of this question as long ago as 1896. In a maneuver critique in that year he pointed out that infantry can not drive out the enemy alone, because it must both move and fire, while the enemy has only to fire; the artillery can not, because the enemy can shelter himself from its fire. Only the combination of the two arms can get results, and this combination can be made effective only by direct tactical connection.

This connection is so much a matter of individual ingenuity in each particular case that special efforts ought to be made by both infantry and artillery officers to practice it at maneuvers. Care ought to be taken, first, by the director, to arrange a code of signals to indicate the target the artillery is firing upon, and then by the umpires to see that proper connection is being maintained. The first is a very easy matter; a common method is to

Firing in maneuvers

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*Revue Militaire Générale, October, 1913.

have batteries fire single shots for an artillery target, and platoon salvos for infantry, supplementing this by placing flags to mark the line of fire if necessary. Most of the fire is simulated at maneuvers, of course, but at least the first round ought to be with blanks, followed by blanks at some specified interval, so that if a battery is not heard for that length of time one may know that it is not in action.

Checking up data

The other matter, that of umpiring, is more difficult. It is too common at maneuvers to see umpires occupy themselves entirely with technical matters—checking up firing data. This should not be neglected, of course; batteries do sometimes fire at maneuvers simply to make a noise. "*Sur quoi tirez-vous?*" asks the umpire in an old French military pleasantry; and the battery commander replies, "*Sur l'ordre du général!*"[*] Umpires should satisfy themselves that the battery commander really has a target, that the guns are laid somewhere near it, and that fire from the actual position with the actual range is physically possible. Gunners are human, and will claim "everything in sight" if they can;[†] but close checking up is useless, for moderate errors in direction or range would quickly be corrected in fire for adjustment.

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[*] Morelle, "Cinquante Années de Canon Rayé," p. 10.

[†] Several conspicuous instances of this, at a maneuver camp at Fort Riley seven or eight years ago, led Captain (now Lieutenant Colonel) McMahon, then commanding a horse battery, to pay his respects to the gunners in question as follows, in some verses read at an assembly of officers:

The gunner, with a crafty eye,
Looked in his telescope;
Then faked some data on the sly,
And scattered round the dope.
He filled his tracks with parallax,
And counted up the dead,
But a quiet young chap in a pretty white cap
Rode up and scornfully said:

Tactical umpiring

The matter of real importance is the testing of tactical, not technical, accuracy. The subject is treated very fully and clearly in the instructions for artillery umpires at the French maneuvers of 1910,* with which this chapter may very appropriately be closed.

NOTES ON UMPIRING.

Fire Effect.

It is impossible, at autumn maneuvers, to decide between the two parties on the merits of the presumed effect of the fire of the artillery.

Infantry fires straight to the front, at short ranges, on the troops directly opposed to it. An infantry unit generally knows when it is under fire. If it does not know, the umpire can tell it so, and oblige it to delay its movement according to the violence of this fire.

The conditions are entirely different as regards the artillery. When the report of a gun is heard, it is im-

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"Stuff, stuff, on Sheridan Bluff;
It looks quite silly," said he.
"Run a bluff if you can on Sheridan,
But you can't run a bluff on me.
Your azimuth is too heavy, I fear,
Your corrector too wide by far;
You never can hit a good cavalryman
By aiming at a star"

The quotation is from memory, and I beg the poet's forgiveness if I misrepresent him.

*Percin, "The Artillery at the Picardy Maneuvers," English General Staff translation, p. 166. These instructions are there followed by several other documents amplifying them, which are too voluminous to be inserted here, but which would well repay reading by all officers assigned to duty at maneuvers.

possible to say whence it comes, and still less where the shell is going to. Moreover, very little artillery firing is heard at maneuvers, since, for the sake of economy, the consumption of ammunition is only one-twentieth of what it would be in war.

The abolition of smoke, and the adoption of fire from the concealed position, have rendered the problem still more difficult, since the presence of the artillery is no longer revealed except by infrequent flashes.

Moreover, the concealed position and the shield enable the artillery, to a certain extent, to continue its fire while it is under fire itself. The enemy's fire no longer produces an absolute cessation of fire, but a momentary interruption, or a reduction in the rate of fire the extent of which it is very difficult to estimate.

Finally, in the days of direct laying the batteries were directly opposed to each other, as is still the case with infantry units. There was then a *duel* between two batteries, and a battery, by firing an effective series, ensured its own safety. Matters are otherwise nowadays, since para. 631 of the Regulations of 8/6/03 has laid down that we are to "proceed by counter-attacks," that is, "to crush a unit of the enemy's line at the moment when it is engaged with another target." In other words, the unit upon which the battery is firing is not that which is attacking it. Therefore the umpire can not pronounce that such a battery has got the upper hand of its adversary or otherwise, according to the manner in which it prepares and executes its fire. To arrive at such a decision, he would have to know which hostile battery is firing on it, and what is the procedure of this latter from a gunnery point of view. Such an investigation is absolutely impossible.

Numerical Superiority.

Since it is impossible to estimate the effect of fire, I have generally seen the umpires, at autumn maneuvers, content simply to count the number of batteries in line on each side at a given part of the battlefield, and, as a matter of course, award the superiority to the force which has most. This method of umpiring is altogether insufficient.

What does the number of batteries in line matter if they have nothing before them, or if the targets visible to them are not those which it is tactically important to destroy?

The duty of the artillery commander is to maintain a due proportion between the number of batteries which he engages and the importance of the task to be carried out. Now the shape of the ground and the conditions of the combat may be such that, of two opposite forces one requires three batteries while the other requires nine. If the latter force has only six batteries, it is in a position of inferiority.

It would be a less serious error, but still an error, to engage twelve batteries. For the surplus of batteries might cause a deficiency at another point.

The system of basing the umpires' decision on the number of batteries in line has this serious disadvantage, that it encourages the commanders of the two forces to expend the whole of their artillery at once, to the great detriment of the proper employment of the arm. For fresh requirements may present themselves before the batteries which have been engaged have completed their tasks.

The Value of Positions.

In the days of direct laying, artillery endeavored to find dominant positions, affording an extensive view in all directions. Positions were then judged on their own merits, independently of any task to be executed from them, and our umpires are still under the influence of the old habit of basing their awards on the intrinsic value of the positions.

Fire from the concealed position has enabled us to use positions which were formerly not available. But a concealed position from which it is possible to engage a particular target is not always suitable for engaging another target. And, for the same target, a position may be characterized as good or bad, according to the degree of cover and concealment which it affords from the enemy's artillery firing on it.

There is no longer such a thing as a position which is good in itself. The estimate of the value of a position must depend on the task to be fulfilled from it, and from the dispositions, known or presumed, made by the enemy's artillery.

Clear Definition of the Task.

Generally speaking, the superiority, from the point of view of employment of the artillery, should be awarded not to the chief commander who has been able to bring up the greatest number of batteries to a given point, but to the commander who has succeeded in defining their tasks most clearly, in choosing their positions with regard to these tasks, and in proportioning their number to the importance of the task to be carried out.

Thus the clear definition of the task appears to be the basis of all umpires' decisions. In other words, the investigations carried out by the umpire should be directed rather to conception than to execution, rather to the work of the artillery commander than that of the group commander,* and rather to the employment of the artillery than to the technical employment of its fire. This view is thoroughly in accordance with the accepted idea that autumn maneuvers are rather a school for the higher commanders than for their subordinates.

Duties of the Umpires.

An umpire will be present with each tactical unit. He will thus be able to hear the orders given by the commander of the troops, and the manner in which the artillery commander translates these for execution. He will learn how many batteries the artillery commander en-

gages and how many he keeps in
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unit ordered to carry out a separat
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is opened, nor even until the batt
action, in order to discover wheth
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such a zone, and whose fire is ch
such an infantry brigade."

"Such an artillery unit has be
the attack on such a supporting
infantry regiment has been ordere

"Such an artillery unit has bee
in the defense of such a position,
coming from such a direction."

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*The French "group" of batteries, it
responds to our battalion.

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CHAPTER X.

PROBLEMS.

Problem No. 1.

Tactical study; battery acting alone, with small mixed force. Fort Leavenworth map.

Situation, discussion and solution.

A Blue force at Platte City, Missouri, in hostile country, has sent a detachment (10th Infantry, Troops A and B, 1st Cavalry, Battery C, 5th F. A.) to reconnoiter in the direction of Easton, Kansas, where a Red detachment is reported.

About 9 A. M., the main body of the Blue detachment begins crossing the Missouri River bridge at Fort Leavenworth. The firing battery is in rear of the leading battalion of the main body, its combat train in rear of all the infantry, its field train with that of the other troops. The battery commander is with the detachment commander at the head of the advance guard reserve; he is followed by a trumpeter; with the advance guard reserve are the battery reconnaissance officer, agent of communication, two scouts and the remaining trumpeter.

Shortly after crossing the bridge reports begin to come in from the cavalry. At Merritt Hill, the colonel informs the battery commander that there is a Red force on the hill just west of the intersection of Shawnee and Twentieth Streets, and that it will probably be necessary to attack.

The battery commander examines the ground in the vicinity for a position in the event of an engagement. The ridge on which he is standing (Merritt Hill—National Cemetery) is in itself a good position, and can be reached under cover; but the range is so long, nearly 4500 yards, that he looks for a more advanced position.

Long Ridge is next noticed, and the range from its crest estimated at 3500 yards. It is impossible to find a completely covered way to it, but the exposure would be for a short distance only, and the battery might possibly not be perceived. If it should be seen by the enemy, and the latter has any artillery, he might try to search the ground behind the ridge; but the space is so great that he could not guess within half a mile the exact location of the battery until it had opened fire.

The hills near the Federal Penitentary appear to offer several good positions, and it should be possible to get within 3000 yards range somewhere in that vicinity. It appears possible to gain the cover of these hills by way of the bridge (XVIII) over Corral Creek, 75 yards west of the electric railway trestle. A few hundred yards of the way between Merritt Hill and this bridge are evidently in plain sight of the enemy, but this exposed portion could be crossed rapidly, and the chances would be small that the enemy could do any damage during the brief moments of exposure. After the cover of the hills south of the creek is once gained, there are so many places where the battery might go that the enemy could not make even a reasonable guess as to its position until it had opened fire.

Technical considerations incline the battery commander to the shorter range position. The effect of shrapnel continues at or near the maximum up to 3000 yards or so, but beyond this range it falls off considerably, chiefly because of the increasing angle of fall, which reduces the depth of the area swept by the shrapnel bullets. Errors of the fuze also become more serious as the range increases. Thus while extreme ranges may be used if necessary, it is much more satisfactory and much more economical in ammunition to come to 3000 yards or less if conditions permit. It may be said, roughly, that a range somewhere between 3500 and 2000 yards is most desirable.

In the present case the position near the penitentiary may be reached with very little more difficulty and exposure than the one at Long Ridge; and there is no special reason for haste in opening fire, for it must necessarily be some time before the infantry can get into position to attack.

Meanwhile, further reports of the enemy are received by the detachment commander, who decides to attack. The battery commander recommends the penitentiary position for the battery. At 9.40 A. M., the colonel sends for the commanding officers of the main body (which is near by on Grant Avenue); while waiting for them he gives these orders to the battery commander:

"The enemy appears to have two battalions, with some mounted scouts, and a battery, on the hill I pointed out to you. I am going to attack. The 1st Battalion, now in advance guard, will move against his front; the 2d Battalion will extend the line to the right, and the 3d will follow the 2d in reserve. The cavalry will cover the left. You will place your battery in a covered position near the penitentiary and support the attack; fire upon the enemy's battery as soon as you can locate it.

Your movement into position will be protected by the advance guard. I shall be with the reserve."

The battery commander calls up his reconnaissance officer and scouts. Pointing out to one of the trumpeters the route he means to follow, he sends him back to the battery with orders as follows:

"Let the chief of the fifth section and the signalmen join me at once with their instruments, and the battery follow, you acting as guide."

Leaving his agent of communication with the colonel, the battery commander, with the reconnaissance officer, the two scouts and the remaining trumpeter, goes to the bridge (XVIII) over Corral Creek near the trestle, noting as he goes that the ground is suitable for rapid movements. Crossing the bridge, he advances far enough to get a view up the ravine running up toward the penitentiary, and see that the battery can move under cover up the left bank of this ravine to the slope east of the penitentiary. He also notes that the infantry of the advance guard is starting forward, and by the time the battery comes up will be in position to cover its movements. He sends back a scout to meet the battery and guide it to this line of approach, while he himself, with the rest of the party, moves direct to the position, selecting a point near the head of the ravine where the battery can easily cross.

An emplacement is selected on the sloping ground between the two branches at the head of the ravine, about contour 875, and the remaining scout posted, dismounted, to mark the position of the right gun. The trumpeter holds all the horses a little in rear. The battery commander and reconnaissance officer take post far enough in front of the line of guns to get a good view and a little to the left of the line of fire of the left gun, and begin to study the enemy's position with their glasses.

In a few minutes the chief of the fifth section and the two mounted signalmen arrive; the telescope is set up at the battery commander's station; the battery commander designates a conspicuous tree within the enemy's lines as a reference point, and the tower of the Staff College building at Fort Leavenworth as an aiming point. The aiming point is shown to the scout marking the position, and the sergeant prepares firing data for the reference point. There being no need for telephone communication in this position, one signalman starts to open flag communication with the agent of communication accompanying the colonel, while the other scout assists in observing the enemy's position. Within a few minutes the scout and trumpeter marking the route rejoin, their duties having been completed. The scout joins the observing party; all led horses are taken to the rear by the two trumpeters.

Meanwhile the battery is coming up. Following the guide, it turns off Grant Avenue at the south side of Merritt Lake, and moves at a trot toward the saddle west of Merritt Hill, the executive officer keeping a hundred yards or so ahead to see that his line of march is covered. At the saddle, he notes that a mounted man is visible from the enemy's position while a dismounted man is not, so slows to a walk and dismounts drivers and cannoneers, remounting them after crossing and taking up the trot again.

A point is soon reached where the battery can no longer keep out of sight, and the pace is increased as much as possible. Shelter is found again after going thus for a few hundred yards, but a trot is kept up whereever the ground permits.

The second guide is met near the railway, with instructions for reaching the position. As the battery approaches, the executive officer comes out still farther ahead; the scout marking the position points out to him the aiming point, then faces in the direction of fire, extends his right arm to the front, and his left along the line of guns, and so remains until the battery is in place. The battery comes up in double section column, turns to the left close behind the scout, moves along the line, and unlimbers to the right; the rear gun in column thus becomes the right or directing gun.

The limbers turn to the left about, under the direction of the first sergeant, clear the battery, and then move up to the penitentiary under cover of the high walls. They take post close to the wall at the east end of the northern face. This cover is perfectly secure, for the limited number of light shell carried by a field battery could make no impression on these heavy walls, even if the enemy should try it. After posting the limbers, the first sergeant returns to the battery, leaving them in charge of the senior caisson corporal.

The battery commander now sends the reconnaissance officer and one scout to join the colonel and assure the maintenance of communication. This will give one officer and two enlisted men at headquarters, all trained in the use of both international and semaphore flag codes. No attempt is made to use telephone connection; the battery has not enough wire, and besides the colonel will doubtless be continually on the move.

When the battery leaves Grant Avenue, the caisson corporal acting as agent for the combat train, who has been marching with the battery, at once reports the movement to the lieutenant in charge of the combat train. He brings it to the front as soon as possible, disengaging it from the infantry column, places it in rear of Merritt Hill, and sends out his agent again to see where the battery goes, report his position and ask for orders. He is directed to come forward when the battery opens fire, and wait at the Corral Creek bridge. At this time the enemy will be occupied in searching for the firing battery, and probably will not notice the combat train as it crosses the exposed space, much less fire upon it.

The enemy will naturally be expecting fire from somewhere in the general neighborhood of the penitentiary, for he will have seen the battery headed in that direction. But this will profit him little under present conditions. The sheltered area into which he has seen the battery disappear is very large, and no clue exists as to the intentions of the battery commander. Both sides will have to watch for flashes and other indications, and locate the target as best they can; but the Blue commander should have an advantage, in that the enemy's position seems to be of less extent than his own, so that the limits of his search are narrower.

The battery commander has arrived long enough ahead of the battery to make all his preparations, so that fire can be opened as soon as it unlimbers. If the hostile battery has not yet shown itself, the fire will be upon any infantry that can be located. This will doubtless compel the artillery to reply. After that, the employment of the battery will depend so much upon circumstances that it is useless to attempt to follow it farther. Its fire will be directed against that arm of the enemy which at the time is capable of doing the greatest damage to the infantry; in determining which this is, the battery commander will rely partly upon orders received from the colonel through his signalmen, and, if these fail, upon his own observation and that of his scouts. At first, it will certainly be the artillery; later, if the enemy awaits the attack, it may be either infantry or artillery, or both alternately. The fire will all be with shrapnel. Against the infantry, of course, shell would not be considered, as any entrenchments must be hasty and light; and against the artillery, no effect upon matériel would be looked for under the circumstances, the effort being merely to make the personnel take cover, and suspend their fire.

Problem No. 2.

Terrain exercise; battery acting alone, with small mixed force. Fort Leavenworth map.

Situation.

A Red force has been defeated west of Leavenworth and thrown back upon the Missouri River, which it seeks to cross by the Terminal Bridge. Pursuit is so close that it is impracticable to destroy the bridge, and a part of the rear guard has been cut off and driven north. The Blue commander estimates that this party consists of about two battalions of infantry, some scattered troopers, possibly half a troop, and a battery without combat train; he believes that it is seeking to cross by a pontoon bridge reported to exist near the old ferry, in the flats north of the post. He, therefore, detaches a regiment of infantry, with a troop and a battery, in pursuit of it.

Marching with his advance guard by way of Seventh Street the regimental commander has reached the corner of Metropolitan Avenue, when rifle fire is heard in front. The cavalry reports that Merritt Hill is occupied, and that one scout believes he has seen an artillery carriage exposed for a moment on Engineer Hill. Turning to the battery commander, who accompanies him, the regimental commander says: "I am going to push the attack, straight to the front and also by the enemy's left. Get your battery into position quickly, as near here as possible, where you can fire upon the enemy's battery if it appears between Grant Avenue and Prison Lane, and where you can also support an infantry attack upon Merritt Hill. Leave your agent with me; fire if you locate artillery, otherwise await my orders."

Required.

Details of position selected, including location of every element of the battery, route of approach, and aiming point. Use sketches or diagrams where possible, with only enough text for necessary explanation.

Solution.

This problem having been prepared for solution on the ground, it is impossible to indicate on the map the minor features of the solutions. The position favored is on the south side of Metropolitan Avenue, right flank of the battery just west of Grant Avenue; approach through Broadway; limbers under shelter of houses in rear; observation from behind the guns. There are three or four other positions in the vicinity, all perfectly practicable but less desirable under the conditions.

Problem No. 3.

Tactical ride; battalion with reinforced brigade. Fort Leavenworth map.

Situation.

A Blue army is near Atchison, a Red army near St. Joseph (the former place some twenty miles up the river, on the Kansas side, the latter about twenty miles farther up on the Missouri side). Hearing reports of Red troops to the south, the Blue commander decides to place a small force at Fort Leavenworth.

This force (1 brigade infantry, 2 troops cavalry, 1 battalion field artillery) enters the reservation by the Millwood road early on the morning of March 19th. From the hills, observers with glasses have made out troops on the other side of the Missouri River, opposite Leavenworth, and frequent reports are received by the commanding officer from his cavalry, out ahead, indicating that a Red force is crossing at the Terminal Bridge and moving north.

The Blue advance guard consists of the 1st Infantry less 3d Battalion. The main body follows at 1000 yards; at its head is the 3d Battalion 1st Infantry, then the artillery battalion; artillery combat trains are at the tail of the infantry.

Instructions.

The artillery battalion will be outlined as follows:*

Battalion headquarters:—battalion commander; adjutant; sergeant major; one scout; one agent of communication for each battery; three orderlies; two signalmen, with flags, wire and one telephone.

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*The organization here indicated was adopted to fit the number of participants available on the day when the problem was actually solved; the work could easily be handled with fewer, or places found for more.

Each battery:—battery commander; reconnaissance officer; executive officer; one scout; two orderlies; one signalman with flags and telephone.

Instruments to be carried as directed by battalion commander:—with headquarters, battery telescope and tripod; with one battery, panorama sight, sight shank and tripod.

Batteries will remain at assembly point (Sherman Hall, Fort Leavenworth) fifteen minutes after departure of headquarters, then follow route marked by the battalion commander. After starting, all will act according to such orders as may be received from the battalion commander, each executive officer moving as may be directed for his firing battery, the others accompanying their battery commanders. All movements of firing batteries will be at a walk unless otherwise ordered.

Orders given battalion commander at Merritt Hill.

"The enemy, strength estimated at two regiments infantry, two batteries, no cavalry, has crossed the Terminal Bridge and is moving north; his advance guard, as you see, is engaged with ours in the valley in front of us, and his main body in the edge of Leavenworth. I shall attack, 1st Infantry east of Grant Avenue, 2d west of it, 3d as reserve by way of Prison Lane. Put your battalion in position near here and support the attack west of Grant Avenue; be prepared to fire east of the avenue also if necessary. I shall be with the 3d Infantry."

Conduct of ride.

The director gives out the above orders as coming from the commander of the detachment. He then gives a series of situations, calling for action by the artillery; the outlined batteries are posted, tactical connection established, targets assigned, etc., as if the troops were present. At each step the details involved are discussed in so far as time permits.

Problem No. 4.

Map problem; battalion with covering force. Taneytown sheet, Gettysburg 3″ map.

Situation.

A Blue invading army is moving south from Gettysburg (twelve miles north of Taneytown); Red troops are reported in force at Woodsboro (eleven miles southwest of Taneytown) and at Frederick (10 miles southwest of Woodsboro). On the morning of July 2d the leading (1st) Blue division is moving southeast across the Monocacy to cover the Northern Central Railway. Its right flank guard (1st Infantry Brigade, 1st Battalion 1st Field Artillery, cavalry, engineers, etc.) marches by the Bridgeport—Taneytown road.

At 9 A. M. the enemy is found to be advancing in two columns east of the Monocacy. The right flank guard is ordered to take position behind the ridge on the north bank of Piney Creek, covering the roads south and southeast from Bridgeport.

The flank guard commander, from the ridge a mile south of Alexander's, sees the support of his advance guard descending the slope on the road to the southeast, and the advance party about to cross Piney Creek. He orders the advance guard regiment (2d Infantry) to take position to cover this road, and to make connection with the advance guard of the division on the Taneytown road; the 3d Infantry to cover the next road crossing the creek, some 2000 yards southwest, and reconnoiter toward the river; the 1st Infantry to remain in reserve at Fink's. Turning to the artillery battalion commander, who is with him, he says:—

"You have heard my orders for the infantry. The enemy's eastern column, at least, which is directed toward Crabster, has artillery. Our division is taking position in readiness behind the ridge running up from here toward Longville, both flanks covered by cavalry. Your battalion will take position in readiness west of Alexander's, prepared to fire in the sector Monocacy—Crabster, until the arrival of the artillery brigade commander, when you will report to him. Messages to Fink's."

Note.—The battalion commander and his adjutant are riding with the staff of the flank guard commander; each has a mounted orderly. With the general's escort are the following artillery details:

1 sergeant, battalion agent; 3 corporals, battery agents; 1 corporal, combat train agent; 3 corporals, scouts; 3 privates, scouts; 1 trumpeter.

The battalion is marching behind the leading regiment (3d Infantry) of the main body, in the following order:—the battery commanders, each with his reconnaissance party; battalion reel and instrument cart; accompanied by the sergeant major and signal detail; Batteries A, B, C, in the order named.

Required.

Action and orders of the battalion commander.

Solution.

Having received his orders from the general, the battalion commander, with his adjutant, turns off the road, on the west side, just north of the crest of the ridge. The enlisted men assemble a short distance north. The battalion commander calls: "All agents."

The agents having reported, he continues, addressing the battery and combat train agents:

"The battalion will form in line of double section columns at close interval, facing south, 200 yards west of Alexander's; combat trains on the right, near the river. Battery commanders report on this ridge."

Addressing the battalion agent:

"Report to the brigade adjutant, over there (pointing), as battalion agent. I shall be reconnoitering on this ridge."

Addressing the adjutant:

"You heard the general's orders. We shall have to find two positions, one facing southeast, the other south, and be ready to put all or any part of the battalion into either one. I will look for a position here facing Crabster; take three scouts, go over to that next hill to the west, and find one facing south. Arrange to come in on a broad front, but not over say six hundred yards, for the rest of the artillery may want to come into action abreast of us. As you know, we are well covered by infantry, anywhere on this ridge."

The battalion commander examines the ground, and selects a position for two batteries east of the road by which he has come up, and one west of it. He then says to the three scouts remaining with him:

"We are looking for the enemy on the hills near Clear View School, which you see over there. Corporal ——, make me a panoramic sketch on a front of one thousand mils east from that hill there (indicating hill 506 half a mile west of the school). Corporal ——, observe that same front with your glasses. Private ——, the troops near this road are our 2d Infantry; keep watch of them, noting how they take position, and particularly noticing the progress of any of their patrols that cross Piney Creek, the stream in our front."

Soon after, the battery commanders report, each with his reconnaissance party; also the sergeant major with the signal detail and cart. The battalion commander gives the following orders:

"The enemy is advancing in two columns between the Monocacy and the Northern Central Railway. We are expecting him to appear at almost any time on those heights to the south, and the division is concentrating along this ridge. Our battalion is to remain where it is, and to prepare to take position for fire anywhere between Crabster and the river.

"The eastern part of the sector seems to be the more important, for we know that the enemy has artillery in his eastern column, and none has yet been reported in the other. For fire in that direction we will take position here, with flash defilade against the Crabster hill—Battery A just west of the road, B one hundred yards east of the road, C on the left of B at one hundred yards interval. Reference point, Clear View School; sector of observation, A, four hundred mils to the right of the reference point; B, three hundred mils to the left; C, three hundred mils to the left of B. My station will be just east of the road; battery stations A and B on the flank towards me, communicating verbally; telephone to C. Limbers Battery A to the right rear; B and C to the left rear.

"For fire farther west, we will use a position to the right, where you see the adjutant. Reconnoiter your positions here and join me over there."

To the sergeant major:

"You see how the telephone line will run. Do not lay the wire yet, but leave the cart here, and you and the signal corporal come with me."

The major then joins his adjutant, receives his report, and lays out a position in like manner for fire to the south. As a reference point he selects one of the houses visible along the road, about a mile west of the Clear View School; he assigns each battery a front of observation of four hundred mils, or twelve hundred mils in all, extending from the hill west of the school to the Monocacy.

All these arrangements being complete, he sends an officer to Fink's to report his dispositions and remain at headquarters to insure communication; he himself remains in observation on the ridge.

Problem No. 5.

Map problem; artillery brigade in attack by division. Taneytown sheet, Gettysburg 3″ map.

Situation.

Continuation of situation of Problem No. 4. The Blue 1st Division has concentrated behind the ridge on the north bank of Piney Creek; the enemy has taken up a defensive position on the general line of the road running east and west, south of Clear View School, his line apparently about two miles long with the school near its center. The division commander estimates the enemy's force at between 9000 and 10,000 rifles and 36 guns, with some cavalry on the flanks, and decides to attack, the indications being that the rest of the Blue army is closer up than the Red supporting troops.

The 1st Brigade is ordered to attack west of Clear View School, the 2d east of it; the 3d is held in reserve near the Piney Creek bridge on the Bridgeport—Taneytown road. The artillery is ordered to support the attack, placing one battalion well out to the left, near the 3d Brigade, and the rest south of Alexander's on the ridge north of Piney Creek.

Required.

Action and orders of the artillery brigade commander, with brief statement of reasons.

Solution.

The artillery brigade commander has doubtless been with the division commander while the latter was forming his plan of attack, and knows his intentions. But in any case, these are fairly evident from the orders:—the two brigades in first line are so much extended that they can hardly be expected to push home, and the main attack is to be directed against the enemy's right.

One battalion is required to be well out to the Blue left. This is evidently in order to have it ready to support the attack of the reserve brigade; also, in part, because the spurs and hills in front of the enemy's position make it difficult for guns in the main position to reach parts of his right.

With these ideas in mind, the artillery brigadier, with his two regimental commanders, rides to the ridge designated as the main position, and confers with the commander of the 1st Battalion 1st F. A., who is in observation there (see Problem No. 4). He communicates the division order to his colonels, and gives his own orders as follows:

To the C. O. 1st F. A.—"Take your 1st Battalion, place it in the more western of the two positions already selected for it, and support the 1st Brigade. Maintain your own connection with the infantry, but keep in communication with me by telephone or flags. Your 2d Battalion will operate separately, under my direct orders. I shall be at division headquarters, near that house about 1000 yards southeast of Alexander's."

To the C. O. 2d F. A.—"Place your regiment in observation here, one battalion on each side of the road leading toward Crabster. Your left battalion will be prepared to fire between Clear View School and the hill northwest of Crabster; your right battalion between the Harner house and the hill west of the school. I shall be at division headquarters; keep in communication with me by telephone or flags. In addition, send me one officer with an orderly and two signalmen."

To the agent of communication, 2d Battalion 1st F. A. (who has been at regimental headquarters)—"Your battalion will move to the vicinity of the Boyd house, on the Bridgeport—Taneytown road, keeping out of sight as much as possible. The battalion commander will report to me for orders at division headquarters, near that house about 1000 yards southeast of Alexander's."

The brigade commander next goes to division headquarters, and reports his dispositions. He requests the chief of staff to send information to the attacking brigades as follows:

To the 1st Brigade:—"Your attack will be supported by the artillery battalion which was with you in the flank guard, from a position about 600 yards south of the Fink house. Maintain your existing connection. Another battalion will be in a position to assist in case of emergency."

To the 2d Brigade:—"Your attack will be supported by a regiment of artillery a few hundred yards southwest of here, and by a battalion south of the Boyd house, on the Bridgeport—Taneytown road. Communicate for the present through the artillery brigade commander here."

The bearer of this latter message is the officer borrowed from the 2d F. A., who is ordered to remain with the 2d Brigade and keep up communication.

When the commander of the 2d Battalion 1st F. A. reports, he is shown the division orders for attack, and given the following orders for his battalion:

"Take a masked position somewhere south of Boyd's and prepare to fire upon the hills and spurs in front of the enemy's line and also upon the extreme right of his position, north of Crabster. Reconnoiter other positions with a view to an advance. Send an officer to me, and keep in flag communication with him."

The artillery brigadier then informs himself as to the location of the ammunition trains, and arranges to have parts of them placed near Alexander's and near Eckardt's and the regimental and battalion commanders notified. He also initiates reconnaissance in front of the main position, to locate more advanced positions for possible use later, and routes of approach to them.

In making these dispositions, the 1st F. A. has been split, and the entire 2d placed between the two fractions. One battalion had to go over to the left of the line; this left a regiment and a half available; it was desired to post the larger part of this force in the center, where it could be used against the enemy's right, and a regiment was more suitable than two battalions. Since the battalion of the 1st was to be entirely removed from the control of its regimental commander in any case, it made little difference whether the physical separation was greater or less.

No detachments are made at this early stage of the action, for assignment to infantry units. The attacks of the two infantry brigades are so closely coördinated that both can be best supported by a central mass of artillery. The 1st F. A. less one battalion is ordered to support the 1st Brigade, with which it is already in communication, but it remains under the orders of the artillery brigadier. The latter retains direct control of the other three battalions, which support the 2d Brigade; one of them is in such position that in case of an emergency on the right flank it could easily be turned over temporarily to the colonel of the 1st F. A., and another is well placed for assignment later to the reserve brigade.

Problem No. 6.

Map problem: artillery battalion with infantry brigade in division attack. Taneytown sheet, Gettysburg 3″ map.

Situation.

Continuation of the situation of Problem No. 5. The Blue 1st Division moves to the attack as ordered. At 1 P. M., the 1st and 2d Brigades have crossed Piney Creek, driving in Red detachments on the spurs overlooking the stream, and are slowly advancing. The artillery is in action in the original positions.

The division commander decides to advance his left, and issues orders accordingly. The following message is sent by the artillery brigadier to the commander of the 2d Battalion 1st F. A., near the Boyd house:

"The 3d Brigade, now in reserve near you, is about to attack; you report to its commander for orders. Notify me by flag signal when you are about to move or change target, so that batteries here may assist."

This message is brought by the officer who has been representing the battalion at headquarters. When it is received, the head of the 3d Brigade is in sight, moving south on the east bank of Piney Creek.

Required.

Action and orders of the battalion commander.

Solution.

The battalion commander sends for his senior battery commander and turns over the battalion to him, with orders to continue the fire, slackening it gradually, to replenish ammunition from the combat train, and to be in readiness to move; the combat train to refill from the ammunition train near Eckardt's (see Problem No. 5) and rejoin. He himself goes to report at headquarters of the 3d Brigade, taking with him his reconnaissance officer, their two orderlies, the battalion agent and scouts, and also the officer just returned to him from headquarters.

Situation No. 2.

When the battalion commander joins the general, he is shown the following order just received from division headquarters:

"The enemy holds a line about two miles long, its right on the hills at the road junction 600 yards north of Crabster. A reserve of about 1000 infantry has been located on the railway southwest of Crabster, and artillery estimated at a battalion west of Crabster. Our 1st and 2d Brigades are engaged along the whole line, the left of the 2d following the high ground on the west bank of the stream flowing north from the road junction marking the enemy's right. We have two troops of cavalry in the vicinity of Taneytown, opposing slightly superior Red cavalry.

"Advance your brigade, leaving one regiment in its present position as division reserve, and attack the enemy's right, prolonging the line of the 2d Brigade. The battalion of artillery now in action near you is attached to your command, and the ambulance company in your rear is ordered to establish a dressing station on Piney Creek south of the bridge."

On the hill a mile southeast of Boyd's (463 on map) the brigade commander issues his orders for attack. Of the two regiments remaining to him, one is directed to pass through the saddle just east of the hill, go up the next stream, and attack astride the Taneytown road; the other to move by the crossroads 1000 yards southwest of Taneytown (490 on map) and extend the line; one battalion of this latter regiment to constitute a brigade reserve, advancing between the road and railway. The brigade commander himself proposes to accompany this battalion. The artillery is ordered to take position near the hill to support the attack.

Required.

Action and orders of the battalion commander up to the time of opening fire.

Solution.

The battalion commander sends the battalion agent back to the old position, with the following written orders:

"Notify artillery brigade commander by flag signal that you are about to change position by echelon. Then send battalion signal detail and two batteries to me, guided by the bearer. Remain there with your own battery, and keep up the fire upon such of our targets as are not taken over by other batteries. Keep in touch with me by youı agent, and when I open fire bring your battery over to rejoin."

He gives verbal orders as follows:

To the reconnaissance officer:—"The battalion will take position here, one battery on the left of this hilltop and the other two on the right, to fire toward Crabster and the hill west of there. Select positions, taking maximum defilade, and post scouts to mark them. Battalion station west of the hilltop, near the left of the